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SOIL SURVEY
OF
MONROE COUNTY, WEST VIRGINIA

BY

J. A. KERR

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SOIL SURVEY OF MONROE COUNTY, WEST VIRGINIA

By J. A. KERR

COUNTY SURVEYED

Monroe County is in the extreme southeastern part of West Virginia. The Virginia State line forms its southern and eastern boundaries. It is irregular in outline, its longest dimension, from northeast to southwest, being about 40 miles and its width varying from about 25 miles in the central to about 7 miles in the extreme southwestern part. The land area included is 473 square miles or 302,720 acres.

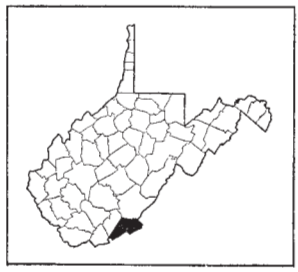

FIGURE 1.—Sketch map showing location of Monroe County, W. Va.

The county lies in the Appalachian region. The relief is dominantly very hilly or mountainous but is diversified throughout by large and small areas of rolling and smooth land, and the mountains themselves are of various degrees of ruggedness and of various elevations.

Physiographically the area within the county consists of (1) a narrow belt of parallel ridges with narrow intervening lowlands, (2) an area of rolling plains, and (3) an area of dissected plateau country.

The ridge and valley belt is in the southeastern part of the county. In its extreme northeastern part, this belt is about 10 miles wide, extending from Carpenter Creek southeastward to the county boundary. The western half of this broad part of the belt consists of Daniels Ridge, Brushy Mountain, and Cove Mountain with intervening narrow but not well-defined lowland belts. Elk Knob on Cove Mountain is 3,400 feet above tide level. Daniels Ridge is a little less than 3,000 feet in elevation.

The remainder of the ridge and valley belt, except the stretch included in the offset of the southeastern county line, is made up of two ridges, Little Mountain and Peters Mountain, and the intervening narrow lowland between them. Both ridges are narrow and stretch entirely across the county. Little Mountain divides into two ridges southwest of Gapmills, the southern, called Gap Mountain, ending in High Head Mountain near the northeastern corner of the county, and the other, called Middle Mountain, continuing to the northeastern county boundary. The elevation of the ridges ranges from 2,500 feet in the extreme southwestern part of the county near Peterstown to about 3,000 feet in the northeastern part. Peters Mountain ranges in elevation from a little more than 3,000 feet to about 4,000 feet. The crest forms the southeastern county boundary, except in the projection from that boundary.

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This projection is made up of the southeastern slope of Peters Mountain, a narrow valley parallel to the mountain occupied by Potts Creek, and Potts Mountain, a ridge parallel to Peters Mountain and about as high.

The rolling plains in the northern part of the county extend 6 or 8 miles west from the ridges described to the foot of Flattop Mountain and southward. These plains are sharply divided into two branches by a northward-projecting highland called Swoopes Knobs. The western area lies west of Swoopes Knobs and east of Wolf Creek Mountain which, like Flattop Mountain, is merely the eastern escarpment of a plateau lying west of the rolling plains area. This branch ends in a cove just south of Ash Hill School. The eastern branch narrows southward to the north foot of Little Mountain, being only about a mile in width in the vicinity of Dropping Lick School. It runs thence southwestward parallel to and along the north foot of Little Mountain to the southwestern boundary of the county. In this stretch along the foot of Little Mountain it is less well defined as a lowland belt than in its broader area in the north-central part of the county. It constitutes a belt of lowland extending throughout the Appalachian belt from the Hudson River to Alabama, lying between the most westerly of the Appalachian ridges and the Allegheny front. Throughout its whole extent, at least from Tennessee northward, it is in few places more than a mile wide except in the northern part of Monroe and the adjacent part of Greenbrier County.

The third physiographic feature of the county, a thoroughly and maturely dissected plateau, occupies the western part of the county. Its eastern boundary is the escarpment known as Flattop and Wolf Creek Mountains, Swoopes Knobs, and the highland west of the lowland belt just described, which runs parallel to Little Mountain. Throughout the southern half of the county this plateau boundary is less well expressed as an escarpment than farther northward. West of its eastern boundary, the plateau slopes westward and southward, declining in the southwestern part of the county to an elevation about the same as that of the rolling plain in the northern part of the county.

Monroe County was organized in 1799. The early settlers came from various communities which at that time were established farther east and north. A large proportion of them were Scotch-Irish, and the present population is composed mainly of their descendants. Slaveholding apparently was not common here, as there are not many negroes in the county. In 1920 the population of the county was 13,141. The population is evenly distributed, except in the thinly settled mountainous districts in the northeast part.

Alderson, situated on the Chesapeake & Ohio Railway at the northwest border of the county, partly in Monroe and partly in Greenbrier County, had in 1920 a population of 1,401. Union, the county seat, located near the center of the county, had a population of 439. Other villages in which high schools are located are Greenville, Peterstown, and Gapmills. Sweet Springs, in the northeast part of the county, is a summer resort.

The Chesapeake & Ohio Railway serves the northern part of the county, passing through Alderson. The southwest end of the county

is served by the Virginian and the Norfolk & Western Railways, which pass through the New River gap. A branch of the Norfolk & Western extends down Potts Creek Valley to Paint Bank.

The county has a good road system. A State highway has been graded for most of its distance across the county, and part of it is surfaced; another, branching from this one at Pickaway, has been graded through to Alderson. A Virginia highway passes through the northeast corner at Sweet Springs. The county roads as a rule follow well-chosen routes, and they are fairly well maintained. On the steeper slopes they are generally worn or graded down to somewhat shaly material which affords good underdrainage and a smooth roadbed. The chert accumulated in the roads which pass through the cherty limestone soils is sufficient to keep them in good condition through most of the year.

The livestock shipped from the county is consigned mainly to Jersey City, Lancaster, and Baltimore markets. The wheat produced is ground at local gristmills, and the surplus is marketed in the neighboring towns. The mining districts in Raleigh County to the west provide a good market for produce, garden truck, and fruit.

CLIMATE

The climate of Monroe County is temperate. The heat of summer at these comparatively high altitudes is less intense than at lower levels in the same latitude. Periods of oppressive heat are of short duration, and even in the hottest season the nights are usually comfortable. The weather is rather changeable through the winter, but many pleasant days occur.

The mean annual rainfall of 38.45 inches is favorably distributed through the seasons, being most abundant through the summer. The frost-free season, between the average last killing frost and the first, is 149 days.

At the higher elevations, the climate is sufficiently cool to affect not only the growth of various crops but also the development of the soils. The records of two stations of the Weather Bureau in Fayette County, one 1,348 feet higher than the other, show a difference of 3° in mean winter temperature and 1.9° in mean summer temperature. On steep mountain slopes, the direction of the slope is of considerable importance; for instance, snow remains much longer on north slopes. Variations in the growth of crops, caused by climatic differences, are more or less obscured by variations resulting from differences in soils, but it seems that the climate of the higher altitudes is especially favorable to the growth of bluegrass, potatoes, and rye, but is rather unfavorable to the production of corn.

There is apparently little difference in the length of the frost-free season in different parts of the county. In fact, in the season of this survey (1925), a late frost was apparently more severe on the plateau near Union than on Swoopes Knobs.

The records of the Weather Bureau station at Union, shown in Table 1, are representative of conditions over most of the county.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Union*

[Elevation, 2,250 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year, (1914)	Total amount for the wettest year, (1918)	Snow, average depth
	° *F.*	° *F.*	° *F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	31.9	69	−34	2.52	4.12	3.86	6.0
January	32.6	69	−16	3.61	2.00	3.90	8.0
February	33.1	72	−10	2.71	3.00	2.25	3.9
Winter	32.5	72	−34	8.84	9.12	10.01	17.9
March	43.0	90	−1	3.74	2.08	3.65	3.2
April	50.6	90	17	2.89	2.27	4.40	.5
May	60.8	95	23	2.76	1.40	1.85	.0
Spring	51.5	95	−1	9.39	5.75	9.90	3.7
June	67.0	95	32	4.32	.97	7.28	.0
July	71.0	100	40	4.62	5.58	6.00	.0
August	70.6	96	40	3.85	2.51	5.20	.0
Summer	69.5	100	32	12.79	9.06	18.48	.0
September	65.1	90	28	2.60	1.26	2.90	.0
October	54.1	90	14	2.84	3.06	4.54	.6
November	41.0	79	2	1.99	1.61	1.76	1.1
Fall	53.4	90	2	7.43	5.93	9.20	1.7
Year	51.7	100	−34	38.45	29.86	47.59	23.3

AGRICULTURE

The water gaps of Jackson River and Second Creek were followed by Indian trails, and this country was explored and settled by a few pioneers early in the eighteenth century. By 1750 there were a number of settlers, mainly on Indian Creek where encampments and cleared fields had been abandoned by the Indians. An early explorer, in 1671, writes of land, "stony, but full of brave meadows and old fields," which may indicate that some of the stony limestone land had been deforested by the Indians.[1]

The early settlers were pioneers and hunters, who produced only such crops of grain and fiber as were needed for home use. The crops included corn, small grains, flax, hemp, and tobacco. A few cattle, sheep, and hogs were allowed to range in the forest with little or no provision for winter feed or shelter. Many of the early settlers, some of whom were weavers, were from the northern part of Ireland.

Later, droves of cattle from the range and bluegrass pastures were driven through to markets in the East. As the population increased, the county was organized with Union as the county seat. The more productive limestone soils were probably occupied early in the nineteenth century, and many homesteads were scattered

[1] Morton, O. F. History of Monroe County, West Virginia, 509 pp., illus. Staunton, Va. 1916.

through the more mountainous districts, where the range for livestock was good.

As time went on, the raising of cattle and sheep continued to be the principal agricultural activities. Tobacco growing was of some importance in the southwestern part of the county, but this crop was grown mainly on newly cleared land and was later discontinued.

Following the construction of the railroads, lumbering became an important source of income. The industry was generally conducted on a small scale, by the use of small portable mills, the lumber being carted to the railway. The forest growth included many varieties of trees, and cutting has been selective. At first poplar, pine, and tanbark oak were the marketable varieties. Later white oak was cut, then red oak, chestnut, gum, and other varieties. At present, crossties and mine props are profitably hauled considerable distances by auto trucks, and walnut from open fields is valuable.

The forests have always been a source of considerable income. However, there has been much waste in their use. Even after the construction of the railways, timber, which in a comparatively short time would have been valuable, was cut and burned. In Potts Creek Valley, for years before the railway was constructed, it was customary to burn over the mountains each year to improve the range. The timber was found to be inferior and worm-eaten, and many butt cuts were not sound enough to use. This condition was doubtless caused, at least in part, by the impaired vigor of the trees caused by forest fires. A large part of the mountain land in that locality has now been cut over and is grown up to stunted timber and sprouts, among which fires are so common that there is little prospect of salable timber being produced. Such land has a very low commercial value.

At the time of the 1880 Federal census, 81.8 per cent of the total area of the county was in farms. The total number of farms was 1,248, and 117,658 acres, or 49.2 per cent of the farm area, was classed as improved land. The acreage in the principal crops was as follows: Corn, 9,992 acres; wheat, 6,744 acres; oats, 3,786 acres; and hay, 9,487 acres. By 1900 the number of farms had been increased to 1,794, and the acreage in the various crops named had been increased about 50 per cent. By 1920, the number of farms was 1,834, but there was practically no increase in the acreage of the principal crops. Most of the land which is well adapted to cultivation is now in use.

The following figures, taken from the 1925 farm census of the Department of Commerce, indicate the acreage of crop land, pasture land of various types, and forest land included in the farms of the county. The land in farms at this date was 81.2 per cent of the total area of the county.

	Acres
All land in farms	237,497
Crop land	44,036
Pasture	105,960
Plowable land	33,556
Woodland	16,579
Other land (including stony pasture land)	55,825
Woodland not pastured	72,234
All other land in farms	15,267

The acreage and production of the various field crops in 1919 are given in Table 2.

TABLE 2.—*Acreage and production of principal crops in 1919*

Crop	Acreage	Yield
	Acres	*Bushels*
Corn	14,306	468,932
Oats	2,275	44,126
Wheat	12,645	140,007
Rye	291	2,595
Buckwheat	801	8,417
Potatoes	353	34,150
		Tons
All tame or cultivated grasses	14,579	18,063
Timothy alone	2,597	3,016
Timothy and clover mixed	10,295	13,023
Clover alone	1,006	1,360
Alfalfa	34	79
Other cultivated grasses	647	585
Silage crops	675	6,295
Coarse forage	3,560	3,752

Thus it may be seen that corn, wheat, and hay are the principal crops. Sufficient corn is produced for local use, little being either bought or sold except between neighbors. The average yield, as reported in the years of the census, has ranged from about 22 bushels to the acre in the early census years to 33 bushels in 1919. This increase results in part from the use of commercial fertilizers, which are commonly applied at a rate ranging from 100 to 200 pounds to the acre. The yields range from very low on the thinner shale soils to 60 or more bushels to the acre on the richer soils. Practically all the corn in the county is cut, and the fodder is used for winter forage. On the larger farms corn is grown for silage. It is an especially suitable crop where the acreage of tillable land is small.

Wheat is grown mainly on the limestone soils, but on many small farms sufficient is grown for home use on shale soils. The average yield in the census years has been about 12 bushels to the acre. When high prices prevail the crop is considered profitable if yields of 15 or 18 bushels are obtained. The straw is helpful in wintering livestock. At present wheat is commonly seeded on disked cornstalk land immediately following the cutting of the corn. On some farms the wheat stubble is plowed under, and the field is reseeded to wheat. The plowed land gives a somewhat better yield of wheat and affords a better seed bed for clover and grass. The wheat crop on all soils is commonly fertilized with an application ranging from 100 to 200 pounds of commercial fertilizer.

Oats are grown on a much smaller acreage now than in former years, as a shorter crop rotation is desired. The average yield has ranged from 15 to 20 bushels to the acre. The straw is used for wintering livestock. Small quantities of commercial fertilizer are commonly used on this crop.

Rye, which is grown on a small acreage, is used mainly where early pasture for sheep is desired. Buckwheat is fairly important on the soils derived from shale and sandstone. A large part of the crop is fed on the farms. This is an especially useful crop for late planting.

Mixed timothy and clover is the principal hay crop, but on the limestone soils the acreage of clover alone is increasing. Red clover is the principal clover crop, but some sapling or mammoth clover is grown. The meadows of mixed hay are commonly plowed for corn the second or third year. On some shale soils, redtop takes the place of timothy. Only a small acreage is in alfalfa, but where limed and fertilized the limestone soils appear well adapted to this crop.

Of late years soybeans have become a crop of considerable importance, producing well on both limestone and shale soils. On small farms, where the acreage of tillable land is small, this crop is especially valuable.

On most farms only sufficient potatoes for home use are grown. On manured and fertilized areas of shale and sandstone soils, large crops of good quality potatoes are obtained, and as the demand is good production is increasing.

Nearly all farmers in the county have small apple orchards, and there are a few larger plantings. Sufficient apples are produced for home use, but the commercial orchards, though apparently on well-chosen sites, have not proved very profitable, as good yields are irregular. Peach trees also bear only irregularly. Commercial orchards, to be profitable, must receive more care than is ordinarily given. Also, the buds are frequently injured by frost.

The following figures show the number of livestock on farms on January 1, 1925.

Horses	4,120
Mules	206
Cattle	17,718
Sheep	19,149
Swine, (total)	5,203
Breeding sows	834
Chickens	118,065

Horse breeding is carried on only to supply the local demand. For general farm work, horses of 1,200 or 1,400 pounds weight are commonly used. Saddle horses are kept by many farmers.

The production of beef cattle is the principal industry of the county. Nearly all the cattle are Hereford or Shorthorn grades. These grade cattle are considered the most satisfactory dual-purpose animals. Summer dairying is carried on, but the calves are generally allowed an abundance of milk. Inferior calves are sold as veal, and the better ones are kept and finished as 3-year-old beef animals. These animals are run on pasture during the grazing season and are carried through the winter on fodder, hay, and straw, with little or no grain. They gain about 300 pounds each summer on pasture but gain nothing in winter. They apparently make considerable growth through the winter but do not put on weight. The 3-year-old cattle are fed corn or silage in March and April, are then turned on pasture, and are marketed in the fall when they have attained a weight ranging from 1,200 to 1,500 pounds.

There is a small creamery at Sinks Grove, but the principal dairy product of the county is butter made on farms. In 1919, dairy products to the value of $173,997 were produced for sale.

A few head of hogs, sufficient to provide meat for home use, are carried on nearly all farms. On some farms, principally in the Sinks Grove neighborhood, some hogs are fed for market.

Small flocks of sheep are kept on many farms through the county. The sheep are generally of mixed mutton breeds. In 1919, the value of wool marketed was $41,891. The lambs are marketed in early fall when they weigh 80 or more pounds. The sheep are commonly allowed the run of the pastures during the winter and are fed roughage but little or no grain. A few head of sheep do not harm bluegrass land in winter. These small flocks are profitable and would be more common if they could be protected from dogs.

Poultry is an important source of income on all farms. Besides chickens, turkeys are kept on many farms.

From 100 to 200 pounds of commercial fertilizer is commonly applied to all the grain crops on all soils of the county. In 1919, fertilizer was used on 79 per cent of the farms, the total expenditure being $91,104 or $62.92 a farm. Superphosphate (acid phosphate) or complete fertilizer comparatively high in phosphoric acid is used on all except limestone soils, on which a complete fertilizer is more common. In recent years the use of lime has become rather common. The use of crushed limestone has made liming more practical, as this material can be produced locally more easily than burned rock. Lime has been used to some extent on all the important soils and has given profitable results.

On most of the farms in the county, labor is hired only at certain times. On the smaller farms, the occasional need for help is met by the exchange of labor among neighbors. In 1919, labor was hired on 44.9 per cent of the farms, the average expenditure on these farms being $137.82. The average size of farms in 1920 was 129.1 acres, and the acreage of improved land was 76.7.

Even on the more productive limestone soils, the farms are commonly not large. In 1920, only 12 per cent of the farms were farmed by tenants and one farm by a manager. In districts where there are large areas of good grazing land, there are a few holdings of 500 or more acres. Here the arable land is generally rented on the share system or is operated by hired labor, as the crops produced are needed to carry the livestock through the winter. Very few farms are rented for cash. The tendency at present is to subdivide the larger tracts of land into farms which can be operated by the owner.

The result of owner operation is evidenced in the generally well-kept appearance of the farms, yards, and buildings. The buildings are well suited to the type of farming practiced, except on the dairy farms where few farmers have barns suitable for dairying.

In 1920 the average value of farm land, exclusive of buildings, was $36.33 an acre. Owing to the importance of livestock production land values do not vary so much with distance from market as is usual where other types of farming are carried on. Good bluegrass pasture land, even though unsuited to tillage, is nearly as valuable as crop land. However, values vary widely, depending on the character of the soil, the surface relief, convenience to roads and schools, and other features. Limestone lands ordinarily range in value from $50 to $100 an acre. Large areas of shale and sandstone soils which are well settled and of favorable relief commonly sell at prices ranging from about $40 to $60 an acre.

SOILS

The characteristics of the soils of Monroe County are attributable to three causes, the climate, the age of the soil, and the character of the parent rocks.

The climate which is, in general, uniform, has been the dominant factor, together with the forest vegetation, in the development of the dominant characteristics of the soils, but since the climate is essentially uniform over the whole county these dominant characteristics, such as light color, low organic-matter content, absence of carbonates in the soil, and generally imperfectly developed surface granulation, are common to all the soils. The soil differences within the county, therefore, are due to some factor other than climate, such as stage of development and character of parent material.

The typical virgin wooded soil has a more or less distinct brownish color which is imparted by the organic matter present. This material is evidently more plentiful in the limestone soils and at the higher elevations, but it is present in small quantities as compared with that in prairie soils. Distinction must be made between organic matter occurring as leaf mold overlying the soil and that incorporated in the soil. Analyses of the surface layers of the Dekalb soils in Nicholas County show a carbon content ranging from 0.69 to 3.33 per cent. Samples from cultivated soils show a content ranging from 1.15 to 3.05 per cent. The darker Dekalb soils become lighter after a few years of cultivation. Where the growth of grass is good in cleared fields which are uncultivated but used for pasture, the soils are darker than the average forest soil. However, the color range in the Dekalb soils is not of great importance.

The climate differs sufficiently at various elevations to produce minor variations in the soils. The trees produce their first leaves about two weeks later at the higher elevations than at the lower. In the higher areas there is considerably greater accumulation of organic matter on the virgin soil. The greater humidity at the higher elevations, caused by the clouds hanging for a long time about the ridges in rainy weather, may be, in part, responsible for this. Above an altitude of 3,000 feet the quantity of organic matter or leaf débris is larger than at lower elevations.

Thus the darker soil occurs on Peters Mountain as a narrow strip along the crest, at elevations ranging from 3,100 to 4,000 feet. On the north slope, it extends irregularly down the slopes of the "steep of the mountain" but is pronounced only in the deep recesses, the soil on the projections being generally only moderately dark. In the water gap back of Lindside, at an elevation of about 2,000 feet, on the north slope of the front ridge the soil is dark, whereas on the south slope it is light yellowish. On rock outcrops on the crest of Chimney Ridge, at a slightly higher elevation, a patch of spongy soil, largely organic, was observed. Generally, on the lower ridges, such as Middle Mountain, this dark soil appears only intermittently.

In this climate, the soils have ordinarily a low content of lime carbonate, as this is one of the more soluble constituents. Not only the soils derived from shale but also those from limestone are acid. The differences in the mineral content of less-soluble minerals, such

as phosphorus, are more marked. The content of lime is not accurately indicated by the degree of acidity. There is doubtless more lime in the limestone soils than in the sandstone soils, but all soils are greatly benefited by applications of lime. Clover and bluegrass grow fairly well on rather acid soil, so long as it is in good physical condition and has a good content of organic matter, but they thrive better, crowd out the weeds more effectually, and yield more heavily on limed land.

A second kind of soil, uncommon in this latitude, occurs in places as especially light-textured material on the south slopes of Peters Mountain. This is the podsol soil, which is characterized by a thin layer, immediately under the leaf mold, of gray, leached soil beneath which the material is a characteristic coffee color, owing to the form of organic matter present. This soil is more common in the Allegheny Mountains farther north in Pennsylvania. It is not of practical importance in Monroe County, as it is mountainous and nonagricultural, but its development is of interest.

The soil on smooth, approximately level areas has generally remained in place, with little loss through erosion, through a long period of time, is typically rather deep, and has assumed a layered arrangement, with layers of characteristic texture and structure. The soil profile consists of three principal layers: The surface soil, which is lighter in texture than the material beneath; the subsoil, in which finer particles, carried down by percolating waters, have been somewhat concentrated; and more or less incompletely weathered material of comparatively unmodified texture and structure.

Each of the horizons mentioned is made up of several layers. The immediate surface soil is mixed with leaf mold. In the second, or subsoil horizon, the upper part is uniform in color but the lower, more compact part may be somewhat mottled with gray. Altogether, the soil on the approximately level areas may be regarded as mature. The subsoil is not so compact as to hinder underdrainage adequate for the successful production of farm crops. In the year of this survey (1925), which was very dry, these soils produced good crops.

The soil on slopes, even that in forest, is constantly though imperceptibly being renewed by the removal of the surface material and disintegration of the rock beneath. Over cavernous or fissured limestone, the stratification is more or less completely broken up from time to time by the solution of the rock, and this results in the slumping of the overlying soil. On slopes, the surface soil is lighter textured than the subsoil. Less of the finer material removed from it has been carried into the subsoil than has been washed away.

Only comparatively small areas of mature soil occur in the county. In the shale soils on gentle slopes and under forest cover, the loss of surface material has been very slow, but most of the soil is rather shallow, and occasional fragments of shale or sandstone at or near the surface indicate its generally immature condition. This is probably caused by the very slow decomposition of the shale, even where it lies near the surface. In some places where shale lies on the surface, it apparently decomposes less rapidly than where it is overlain with soil.

The noncalcareous rocks in most of the formations in the county are varied but not sufficiently so to greatly influence the soil. For instance, the noncalcareous shales, whether dark, gray, green, or yellow, generally weather into yellow material even in their partly weathered condition. Any carbonaceous material present has little effect on the soil. The red shales give rise to red soils.

Most of the soil derived from interbedded shale and sandstone is of the same texture as that derived from shale alone. The sandstone is very fine grained, breaking down into clay, silt, and sand. On slopes the soil materials are more or less mixed, and the scattered beds of sandstone render the soil only a little more friable in general. Most of the noncalcareous rocks in the county give rise to a yellow soil, varying in texture, stoniness, and other characteristics. It is necessary, however, to map various combinations of soils as undifferentiated, and, especially in the mountains, to consider the predominant soil, with inclusion of other soils.

The exposures of the various formations are somewhat irregular in the plateau and are very irregular in the mountains. In the plateau, the formations are folded along northeast-southwest lines, in places very strongly, but on the whole much less strongly than in the mountains. Throughout the county, the width of the outcrops of the several formations varies according to the inclination of the rocks and the relief more than with the thickness of the formation.

The Dekalb soils are characterized by light-brown, yellowish-brown, or yellowish surface soils and yellow subsoils. Both surface soils and subsoils are acid. Under the native forest cover, a thin layer of leaf mold covers the surface. The content of organic matter is not large and is somewhat variable in different places. At the surface there is, in many places, a film or shallow layer of gray soil. The subsoil is friable with little or no concentration of clay in the lower part. The Dekalb soils are generally somewhat shallow and are incompletely weathered. There is commonly more or less partly or slightly weathered shale in the soil at a slight depth, and the surface soil is shaly in places, even on very gentle slopes. At a comparatively slight depth, the surface soil is underlain by partly decomposed shale and clay. Shattered bedrock is reached at a depth varying from 2 to 4 feet. On the gentle slopes the average depth to bedrock is apparently no greater than on steep slopes. At the surface of the shattered rock, some gray, partly decomposed shale is present in many places. The shaly silt loam, silt loam, stony loam, fine sandy loam, stony fine sandy loam, gravelly loam, and very fine sandy loam members of the Dekalb series are mapped.

The Tilsit soils are derived from sandstone and shale material similar to that from which the Dekalb soils were derived, but they have reached a more advanced stage of weathering. The surface soil, beneath the leaf mold, is dark grayish to a slight depth and is pale yellowish below. The subsoil is heavier in texture than the surface soil. The upper part is friable and is yellow or slightly mottled; the lower part, at a depth ranging from 20 to 30 inches, is somewhat compact and is mottled yellow and gray. This layer may grade into completely decomposed material, some of which is red, or it may directly overlie shattered, partly decomposed rock. This soil is acid throughout. Tilsit silt loam and Tilsit very fine sandy loam are mapped.

The Meigs soils comprise undifferentiated Upshur and Dekalb material and are intermediate in color between those two soils. Very commonly beds of the red shale and rocks of other colors are closely interbedded, and the various soils occur in narrow strips and small patches. Most of the land is strongly rolling or steep, and the soil materials are considerably mixed by wash and slump. More or less of this composite soil has a somewhat reddish-yellow subsoil, the reddish cast being more pronounced when the soil is wet. The stony silt loam, stony loam, colluvial phase, gravelly silt loam, colluvial phase, and silt loam of this series are mapped.

The Summers soils typically have very dark or almost black surface soils, with a large content of organic matter. These are underlain by dark-brown or dark reddish-brown subsurface soils, and at a greater depth by yellowish or Indian-red friable subsoils. The Summers soils occur mainly in the higher well-drained situations and are derived from the same materials which at lower situations give rise to soils of the Upshur and Dekalb series. Summers stony loam is mapped.

Soils of the Westmoreland series are composed of undifferentiated Dekalb material and soil from interbedded shale and limestone. They have light-brown or brown surface soils and yellow, brownish-yellow, or reddish-yellow friable subsoils. Some soil from calcareous shales in massive form, but weathering to shale similar to that derived from noncalcareous rock, also occurs. The surface of these soils ranges from gently rolling to steep, and the various interbedded rocks, outcropping in close succession, give rise to somewhat mixed soils which are modified by the influence of the limestone. The proportion of limestone varies but in most places is not large, and much of the soil is Dekalb or similar material, though it is more productive. This soil is acid throughout. Westmoreland stony silt loam and Westmoreland silt loam are mapped.

The Hagerstown soils have brown surface soils and yellowish-brown or reddish-brown friable subsoils. Even on smooth areas, the subsoil is uniform in color and structure, though it may be somewhat heavier in the lower part. The soil is acid throughout, except where it occurs in close contact with the limestone bedrock. Hagerstown silt loam and Hagerstown and Lowell stony silt loams, undifferentiated, are mapped.

Soils of the Lowell series have brown silt loam surface soils and yellow plastic clay subsoils. They are derived from the magnesian Beekmantown limestones and are very stony in Monroe County. Lowell stony silt loam is mapped.

The Frankstown soils are characterized by yellowish-brown, brown, or grayish-brown surface soils and yellowish friable subsoils. These soils are derived from siliceous limestone and highly calcareous shales and are acid throughout. The typical soil contains some chert in addition to porous partly decomposed limestone rock. In Monroe County, however, very little chert is present in the parent rock. Frankstown silt loam and Frankstown, Hagerstown, and Lowell stony silt loams, undifferentiated, are mapped.

The Frederick soils have grayish or light-brown surface soils and reddish subsoils. They are derived from impure limestone and are very cherty throughout the county. Frederick gravelly silt loam is mapped.

The Clarksville soils are derived from cherty, impure magnesian or dolomitic limestones. The surface soils are yellowish or yellowish brown, and the subsoils are yellow and friable. Clarksville gravelly silt loam is mapped.

The Belmont soils are also composite soils and are similar to the Meigs soils, except that some limestone is interbedded with the variegated shales, making the soil more productive. Some soil from red, earthy limestone, more or less mixed with red shale and white limestone, was included in mapping. Belmont silt loam is mapped.

The Shelbyville soils are the matured soils from practically pure limestone. They are characterized by yellowish-brown surface soils and yellowish upper subsoil layers. The lower subsoil layers are only slightly compacted and contain a large quantity of concretionary ferruginous material. In Monroe County the Shelbyville soils do not contain so much of this material as typical, but they are fairly well matured. Shelbyville silt loam is mapped.

The terrace soils differ from each other, not only in the character of the parent material but also in the stage of maturity to which they have developed. Deposits which have been above overflow for a long time have typically developed mature profiles except where the gradual wearing away of the material or its slumping over dissolving limestone has prevented development.

Soils of the Elk series represent the less modified deposits from upland soils, some of which are limestone soils. They correspond to the Huntington soils which occur in first-bottom positions. They are characterized by brownish surface soils and yellow subsoils. The material in the lower part of the subsoil may be somewhat dense, or there may be more or less incipient mottling. Elk silt loam is mapped.

The Monongahela soils differ from the Elk in that they are more mature, the surface soils average somewhat lighter in color, and the lower part of the subsoils is somewhat mottled. Monongahela silt loam is mapped.

The Holston soils are matured deposits derived from Dekalb and Meigs upland soils, and they strongly resemble the corresponding residual Tilsit soil. Holston silt loam is mapped.

The Huntington soils are well-drained soils which are derived partly from the limestone upland soils. They are characterized by brown surface soils and yellowish-brown subsoils. There may be a little mottling in the lower part of the subsoil, but predominantly the well-drained, well-oxidized material continues to a great depth. Huntington fine sandy loam and Huntington silt loam are mapped.

The Lindside soils are composite soils, intermediate between the Huntington and Holly soils. They vary from one soil to the other so irregularly that no separation can be made. Lindside silt loam, with a light-colored phase, is mapped.

The Pope soils are well-drained soils derived from Dekalb and Meigs deposits. They resemble the Huntington soils but are not so productive. Pope gravelly loam and Pope loam are mapped.

The Atkins soils are poorly drained soils formed from deposits from Dekalb and Meigs soils. They are similar to the Lindside soils, and there is slight difference in their productiveness. Atkins silt loam is mapped.

Rough stony land is a miscellaneous classification and includes areas so extremely rough and stony that they have no agricultural value.

The distribution of the soils of Monroe County is shown on the soil map which accompanies this report. The acreage and proportionate extent of the various soils are given in Table 3.

TABLE 3.—*Acreage and proportionate extent of the soils mapped in Monroe County, W. Va.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Hagerstown and Lowell stony silt loams, undifferentiated	17,152	5.7	Dekalb shaly silt loam	40,448	13.2
Hagerstown silt loam	2,112	.7	Dekalb gravelly loam	5,248	1.8
Lowell stony silt loam	2,048	.7	Summers stony loam	2,944	1.0
Frankstown silt loam	21,696	7.2	Meigs silt loam	41,344	13.5
Frankstown, Hagerstown, and Lowell stony silt loams, undifferentiated	2,048	.7	Meigs gravelly silt loam, colluvial phase	3,584	1.2
Frederick gravelly silt loam	8,192	2.7	Meigs stony silt loam	18,560	6.2
Clarksville gravelly silt loam	9,344	3.1	Meigs stony loam, colluvial phase	15,488	5.1
Shelbyville silt loam	2,112	.7	Huntington fine sandy loam	1,600	.5
Belmont silt loam	960	.3	Huntington silt loam	2,304	.8
Westmoreland silt loam	23,680	7.8	Elk silt loam	1,088	.4
Westmoreland stony silt loam	4,032	1.3	Pope loam	1,920	.6
Tilsit very fine sandy loam	1,856	.6	Pope gravelly loam	896	.3
Tilsit silt loam	4,032	1.3	Lindside silt loam	2,112	.9
Dekalb fine sandy loam	11,072	3.7	Light-colored phase	576	
Dekalb very fine sandy loam	4,480	1.5	Holston silt loam	1,408	.5
Dekalb stony loam	11,264	3.7	Monongahela silt loam	1,024	.3
Dekalb stony fine sandy loam	7,168	2.4	Atkins silt loam	1,216	.4
Dekalb silt loam	25,728	8.5	Rough stony land	1,984	.7
			Total	302,720	

HAGERSTOWN AND LOWELL STONY SILT LOAMS, UNDIFFERENTIATED

The surface soil of Hagerstown stony silt loam, to a depth of 2 or 3 inches, typically consists of dark-brown silt loam passing into brown or somewhat reddish-brown heavy silt loam. This layer is underlain, at a depth ranging from 6 to 14 inches, by yellowish-brown or reddish-brown silty clay loam or silty clay. At a depth of about 2 or 3 feet the clay becomes somewhat heavier in many places and is slightly plastic when wet. The Lowell soil differs from the Hagerstown in the more yellowish-brown color of the surface soil and the more yellowish subsoil, which is of about the same texture and structure as the Hagerstown soil in the upper part but is more plastic in the lower part. An intermediate soil, similar to the Hagerstown except that the lower part of the subsoil is somewhat more plastic than typical, is also included.

The Hagerstown and Lowell soils are similar in origin, character of forest growth, and adaptation to bluegrass and other crops. The greater part of this undifferentiated soil is Hagerstown, or the intermediate soil previously mentioned. Typically, these soils are the product of the less siliceous limestones and are associated with the Frankstown soils which represent the more siliceous beds. However, they are not necessarily derived from pure limestone but from limestone containing sufficient pure limestone near the surface to cause considerable slumping, which promotes oxidation. The rocks are fissured and deeply weathered along these fissures, forming pockets which are filled with slumped material. Where the total thickness of the Greenbrier formation is mapped as this soil, some

strips of Frankstown soil, over the more siliceous beds, have been included in mapping.

This soil is stony, with ledges, outcropping bowlders, or projections of massive limestone but very few small fragments. Strips and patches of deep soil alternate with these rocky areas, but these are too small to be farmed separately. Some of the land is very stony, approaching the character of rough stony land except for the pockets of soil which support a good growth of timber or bluegrass, rendering this soil much more useful for pasture than typical rough stony land.

In the southwest part of the county, where the Greenbrier formation is on edge, the entire outcrop is mapped as this soil. Some Frankstown and Frederick soils are included, but siliceous rock apparently does not make up so large a part of the formation as would appear from the extent of these soils on smoother areas and those overlying less greatly inclined rock. Some of the soil here is also modified in places by sandstone and sandstone soil which has worked down from the Pocono formation. Where the depth of this material is slight, bluegrass grows very well. Except for a thin layer of alkaline soil, where it is in contact with limestone, this soil is strongly acid throughout.

The surface of this soil is generally rolling or rather steep. Sinks are common on the smooth areas. The land was originally wooded with oak, black walnut, poplar, sugar maple, black locust, and other trees. In some places, probably 20 per cent of the growth was black walnut. Nearly all the land is cleared and in pasture. Very little of the soil is cultivated, even where it would appear to be practical, because even a few rocky patches make plowing difficult and the land gives good returns as pasture. These soils constitute the best bluegrass pastures in the county.

Farmers recognize differences not only in the growth but in the quality of bluegrass on different farms. A strip of Hagerstown soil extending north and south just west of Union is considered the best bluegrass land in the county. The bed from which this soil is derived has an unusually wide outcrop here along a syncline. Elsewhere, the soil apparently over this same bed was not recognized as especially good, perhaps on account of its narrower outcrop. The available analyses show a range in the content of phosphoric acid (P_2O_5) in the Greenbrier limestones from a trace to 0.043 per cent. These differences may be increased in the soil derived from them to such an extent that some of this soil may represent the Maury series.

Other circumstances modify farming conditions. It seems that where this land has formerly been farmed, the growth is not altogether so good. Though some very stony areas are considered good grazing land, in places the total rock outcrop is so large that the land is not nearly so good for grazing purposes as is the typical soil. In places, patches of shallow soil occur, and north of Willow Bend on one such area, much larger than the others, the soil, probably a shallow phase of a Colbert soil, is gray and is covered by a growth of short wild grass which affords good pasturage, except in dry seasons. Elsewhere, only very small patches of this shallow soil occur.

The stand of grass over this soil is not uniform. On the richest pastures, stickweed and other weeds have choked out the bluegrass in places, and a little yarrow is seen.

Some fields are especially valued because, on them, cattle may be finished for market without a grain ration. Beef cattle thrive better on comparatively smooth pastures, if the growth of grass is so heavy that the animal may get sufficient grass with very little exercise. The grass on southern and eastern exposures and on smooth land is considered more nutritious than that on northern slopes. A convenient supply of good water is also important. The best pastures are reserved for finishing the 3-year-old cattle, and younger animals are pastured on the other fields.

Over most of this land, about 3 acres are sufficient to carry a steer and to produce a gain in weight of about 300 pounds each season. The cattle are carried through the winter on fodder, hay, straw, and, on many farms, some silage is fed in March and April. When silage is not used, some grain is fed during these months. However, the cattle gain little or may lose a little weight during the winter.

HAGERSTOWN SILT LOAM

The surface soil of Hagerstown silt loam typically consists of brown mellow silt loam from 10 to 14 inches thick. This layer passes into yellowish-brown or reddish-brown friable silty clay loam, which becomes heavier with depth. It grades into silty clay, which is more uniformly reddish in color than the upper part of the subsoil and which becomes slightly plastic when wet.

The soil throughout has a well-defined granular structure, which is apparent when moist. The granules have smooth surfaces and glisten somewhat when covered with a film of moisture. Larger granules readily break to smaller pieces, so that they are very minutely subdivided. Throughout the surface soil and subsoil are scattered soft concretions, generally about the size of a pinhead. Both surface soil and subsoil are somewhat acid, except where the soil comes in contact with occasional projections of the limestone bedrock.

A heavy growth of bluegrass covers the timbered areas, which are probably more open than those in the original forest. The surface soil, to a depth of 2 or 3 inches, is dark with organic matter composed mainly of decayed grass roots.

This soil in most places is very deep. It is derived from nearly pure limestone and appears well oxidized down to bedrock.

Hagerstown silt loam is not extensive in Monroe County, appearing only in small areas in association with Frankstown silt loam, which is the product of the more impure limestone beds. However, in addition to the areas shown on the map, numerous small areas have been included in mapped areas of the Frankstown soil. The timber growth consists of sugar maple, white oak, walnut, poplar, and other hardwoods. Nearly all the land is cleared and under cultivation or in bluegrass pasture. Corn, wheat, and hay are the principal crops. Corn yields from 40 to 80 bushels, wheat from 12 to 18 bushels, and clover and timothy from 1 to 2 tons of hay to the acre. Bluegrass makes a heavy growth, and the pastures are used to some extent for finishing cattle. One plot of alfalfa was seen on

an area of this soil which had been limed and fertilized. Although only two cuttings are commonly obtained, as bluegrass has a tendency to encroach and choke out the alfalfa, this is a profitable crop. Large yields of corn are obtained when alfalfa sod is plowed under.

LOWELL STONY SILT LOAM

The surface soil of typical Lowell stony silt loam consists of brown silt loam which is underlain, at a depth ranging from 6 to 10 inches, by yellow plastic clay. The land is very stony, with numerous projecting ledges of limestone. This soil occurs mainly in the limestone valley northwest of Peters Mountain, where it is derived from the magnesian Beekmantown limestones. The deeper stone-free soil from this same formation is mainly Clarksville, and the stony soil includes much lighter-colored soil similar to the Clarksville. There is not so much chert in this soil as is in the Clarksville soil, which seems to have accumulated from rock of considerably greater thickness. In Monroe County this soil is not so fertile as typical Lowell areas elsewhere. The land is used mainly for pasture. The bluegrass growth is mixed with a large proportion of other native grasses, and the sod is not so heavy as on the typical Lowell soils.

FRANKSTOWN SILT LOAM

The surface soil of Frankstown silt loam consists of light-brown, yellowish-brown, or light-yellow silt loam, somewhat darkened by organic matter at the immediate surface. At a depth ranging from about 10 to 14 inches this grades into yellow friable silty clay loam, which continues to a depth of 3 or more feet or passes into yellow or dull-reddish clay containing porous or solid limestone rock. In places the soil to a depth varying from 18 to 24 inches may be typical in color, but it passes into a lower subsoil layer which is reddish yellow, yellow stained with reddish brown, or reddish brown, similar in color to the corresponding layer of the Hagerstown soil. Some Hagerstown soil and a few small patches of Lowell soil are included in mapping.

Both surface soil and subsoil are somewhat acid. The soil when moist shows a granulated structure. The subsoil may easily be crumbled to small fragments and these to smaller ones, as the subsoil material is very minutely divided by cleavage planes.

Frankstown silt loam is derived predominantly from siliceous limestone and to a slight extent from calcareous shale. The impurities are distributed through the rock, but there is practically no chert. The impurities in much of the limestone tend to cohere. In such areas some of the material does not break down into soil on solution of the lime but forms rotten, porous shale or soapstone. The presence of some small fragments of this rock in the lower part of the subsoil is somewhat characteristic of the soil, but in most areas very little of this rock or solid limestone is near the surface.

The rocks vary in their content of impurities, and some interbedded limestone is nearly pure. Two beds of red and variegated shale, a few feet in thickness, also occur within the Frankstown areas. In places the soil from these could be separated in mapping,

but more commonly their outcrop is very narrow and is obscured by soil derived largely from siliceous limestones. The purer beds of limestone generally outcrop as strips of stony Hagerstown and Lowell soils and were mapped in those series, but intermittently they are covered with soil from more impure rock which largely retains its yellow color even where the lower part of the subsoil is reddish-brown clay.

Frankstown silt loam is extensive through the north-central part of the county where it occurs in association with other limestone soils. The surface is gently rolling or rolling, and drainage is mainly through underground channels. The drainage outlets usually occur at the boundary of the Frankstown and Hagerstown soils, with drainage ways from the Frankstown soil leading to them. Within the Frankstown areas are numerous small depressions, and good springs, flowing only a short distance before disappearing, are numerous. Nearly all the land is cleared and is either under cultivation or in pasture. The forest is of hardwood, mainly oak, with some poplar, walnut, and other trees. Corn, wheat, and hay are the principal crops. Corn ordinarily yields from 40 to 70 bushels to the acre, wheat from 12 to 18 bushels, and clover and timothy from 1 to 2 tons of hay.

This soil is utilized for general farming. The more rolling areas and the associated soils are in permanent pasture. A few head of dual-purpose cows are kept, and summer dairying is carried on. Some farmers own pasture land at a distance, where cattle are grazed through the summer. The young cattle are pastured until they are 2 or 3 years old and are then sold as stockers or finished cattle. On most farms, only sufficient land is under cultivation to provide feed for carrying the livestock through the winter. A few hogs are marketed, and some grain and hay are sold locally.

A rather short crop rotation is commonly used. Only one crop of corn is grown and generally but one crop of wheat before seeding the land down to grass. One, two, or three crops of hay are then cut. From 100 to 250 pounds of complete fertilizer, generally analyzing about 2-8-2[2] are applied to corn and wheat by nearly all farmers, but some prefer superphosphate.

Bluegrass thrives on land in good tilth. Where worn-out land has been seeded or where the land may naturally be less fertile than typical, inferior native grasses are common, and in some pastures of typical soil, apparently in good tilth, more or less broom sedge is mixed with the bluegrass.

Lime has not been commonly used, but in recent years many farmers have applied ground limestone and consider its use profitable. The growth of hay is considerably improved through the use of lime. On one farm the crop was not only heavier but the hay was much freer from whitetop on limed land. The profit from liming continues for a number of years, and probably the slow returns from its use are responsible for its lack of popularity. However, liming is becoming more common and might prove profitable even on permanent pasture, as lime promotes the growth of bluegrass.

[2] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

FRANKSTOWN, HAGERSTOWN, AND LOWELL STONY SILT LOAMS, UNDIFFERENTIATED

This classification was used to designate lands of these mixed soils, where the parent rocks are closely interbedded, giving rise to narrow strips of the various soils. Strips of land free of stone, mainly Frankstown silt loam, are included, but the land as a whole is so interrupted with ledges of limestone that it is difficult to farm and is used mainly for pasture. Some of the included Frankstown soil is derived from more shaly limestone than is common, and the soil is shallower and contains more shale than is typical. Another bed, weathering to massive soapstone in places, forms somewhat stony soil, and the ledge outcrops in places. The only large areas of land mapped as these undifferentiated soils occur southeast of Union, at the foot of Little Mountain. The surface is rolling and the land makes good bluegrass pasture, for which purpose it is mainly used.

FREDERICK GRAVELLY SILT LOAM

The surface soil of typical Frederick gravelly silt loam in forest is brown silt loam which, at a depth of 1 or 2 inches, passes into rather grayish-yellow, grayish-brown, or light-brown silt loam. At a depth ranging from about 10 to 18 inches this layer is underlain by yellowish-red, reddish-yellow, or yellow friable silty clay loam. The lower part of the subsoil is more uniformly reddish, generally light-red or yellowish-red brittle clay, with some yellow and pale-yellow splotches. This in turn is underlain, at a depth varying from about 4 to 6 feet, by less-weathered material which is commonly heavy, somewhat plastic red and yellow clay. In many places the yellow color increases with depth. The bedrock of siliceous cherty limestone appears in places at a depth of 3 or 4 feet. In other places ledges outcrop a little at the brow of steep slopes, but generally the weathered soil continues to a depth of at least 4 or 5 feet.

The surface soil of cultivated areas is generally grayish or pale brown in color. Under sod, the surface soil, to a depth of 2 inches, is dark brown, owing to its large content of organic matter. Both surface soil and subsoil are acid. Varying quantities of chert are present in both surface soil and subsoil, generally making up from 10 to 25 per cent of the material. Chert is much less abundant below a depth ranging from 2 to 4 feet. The content of chert is generally greater on the smoother land. The fragments are nearly all small, varying from one-half inch to 2 inches in diameter. Most of the chert is dense but some is porous, and a little shaly rock is present in places.

Frederick gravelly silt loam occurs mainly in two large areas in the north-central part of the county. It also occurs to some extent in the valley north of Peters Mountain. This soil is derived from the lower beds of the Greenbrier formation and the Beekmantown limestone. This latter limestone is magnesian but not sufficiently so to cause any marked difference in the soil which consists of leached impurities.

The land is rolling, and nearly all of it is cleared, except that reserved in timber for wood lots. The forest growth consists of red, white, and other oaks, with some chestnut and other hardwoods.

Livestock farming, with a large part of the land in more or less permanent pastures, is carried on. On farms where rotations are practiced, corn ordinarily yields from 30 to 60 bushels to the acre, wheat from 12 to 20 bushels, oats from 20 to 30 bushels, and timothy and clover hay, 1 ton or more.

An application ranging from 100 to 250 pounds of complete fertilizer is commonly applied to grain crops. A common formula is 2–9–2. Bluegrass thrives on recently cleared or fertile farmed land but on depleted land which has been returned to pasture is not so plentiful or luxuriant. Although this soil is not so productive of bluegrass as the Hagerstown soil, the pasturage on it is good, and cattle may be finished where the fields are not overstocked. Ordinarily, the more rolling land is used for pasture and the smoother land is in cultivation. Where an old sod is broken, good crops of corn may be obtained for several years. Such land is not apt to wash much for some time, but it is generally regarded as better practice to grow only one crop of corn and to keep rolling land in grass as much as possible. Lime has not been used to any great extent on this soil but has given good results where used.

Small orchards are found on most farms, and one rather large apple orchard, in an apparently favorable situation, was noticed. This orchard, however, bears irregularly and has not proved profitable. In recent years, soybeans and potatoes have been grown to some extent and are regarded as good crops.

CLARKSVILLE GRAVELLY SILT LOAM

The surface soil of Clarksville gravelly silt loam typically consists of light-brown silt loam, underlain at a depth of about 2 inches by pale-yellow silt loam. At a depth varying from about 8 to 12 inches this passes into friable yellow silt loam, which may become only slightly heavier with depth or give way to friable silty clay loam. In places the lower part of the subsoil is somewhat reddish, and some Frederick gravelly silt loam is included with mapped areas of this soil. In most places small chert fragments are abundant from the surface down, and in patches larger fragments are found.

This soil is derived from the magnesian or dolomitic Beekmantown limestone. It occurs in a belt extending the length of the county on the southeast side of the St. Clair fault, in the valley northwest of Peters Mountain. The formation is in part covered with colluvial material, but the line of demarcation of the soils is generally very sharp, and little colluvial material is present within the soil. The forest growth consists mainly of chestnut and oak, with some maple, black gum, and other hardwoods. Probably 90 per cent of the land is cleared and under cultivation.

Agriculturally little distinction can be made between this soil and Frederick gravelly silt loam. However, because bluegrass does not seem to thrive so well on this soil, it is not so much used for pasture as for cultivated crops. The more stony mountainous areas are in pasture. The land is benefited by liming. The magnesian limestone is not used for liming, but the purer calcium limestone of the adjoining formation is preferred even when the rock is prepared by crushing.

SHELBYVILLE SILT LOAM

The surface soil of typical Shelbyville silt loam consists of a layer of brown silt loam, somewhat darkened with organic matter, which, at a depth ranging from 2 to 4 inches, is underlain by pale-yellow silt loam. At a depth varying from about 10 to 18 inches this layer gives way to yellow silty clay loam, which shows a granular structure when moist. Between depths of about 20 and 30 inches this material becomes somewhat mottled with gray. The gray mottled layer varies from a few inches to a foot or more in thickness and is somewhat compact in the lower part. This layer may, in turn, be underlain by silty clay, mainly yellow but containing some red and green mottles, or it may overlie a bed of soft, partly weathered siliceous limestone. Numerous small dark concretions, many of them about the size of a pinhead, occur through the surface soil and subsoil. Limestone bedrock occurs at a depth ranging from 3 to 6 feet, and the soil is presumably derived from this limestone.

This is a mature soil. It occurs on smooth surfaces, with the corresponding Frankstown soil on the sloping land. The compaction in the lower part of the subsoil is not pronounced, and apparently no marked difference in moisture conditions exists between this soil and the Frankstown, so far as crop growth is concerned. The soil is not extensive in Monroe County, but it occurs in numerous areas throughout the limestone lands in the north-central part. The land is usually farmed in connection with other soils, and as it is smooth and productive it is nearly all under cultivation. The timber growth is of oak, walnut, poplar, and other hardwoods. Corn, wheat, and hay are the principal crops. The land is well farmed, and corn ordinarily yields from 50 to 80 bushels, wheat from 12 to 20 bushels, and clover and timothy hay from 1 to 2 tons to the acre. An application varying from 150 to 250 pounds of commercial fertilizer, generally a 2–8–2 mixture, is used on the grain crops. A common rotation is corn, wheat two years, clover and timothy two years. Even a 3-year rotation, without timothy, is sometimes used. The land is plowed for the second crop, and thus a better seed bed for grasses is obtained. On some farms some corn and hay are sold, but more commonly livestock is pastured on other soils and wintered on crops grown on this soil. Bluegrass thrives, but only small areas of this land are used for pasture. Clover does well on unlimed land, but applications of lime on this soil near Pickaway have increased the hay yields.

A few small areas of another mature limestone soil, Dickson silt loam, were included, on account of their small extent, with mapped areas of Shelbyville silt loam. This included soil is derived from more impure limestone than the Shelbyville. It contains some small chert and shale rock fragments throughout. An area of this soil, mapped as Shelbyville, is about 1½ miles east of Gapmills, and two areas are north of Keenan in association with Frederick gravelly silt loam. In the first-mentioned area, a heavy plastic subsoil is reached in places, and underdrainage does not seem to be good. This land is in pasture. Those areas near Keenan are better drained and are under cultivation.

BELMONT SILT LOAM

Belmont silt loam is a composite soil, made up of Meigs silt loam, with a little soil derived from lighter-colored shale; limestone soil, mainly Hagerstown and Lowell material; and intermediate or mixed soils. It is either derived from interbedded shale and limestone or is soil mixed by colluvial material. In the middle part of the Greenbrier formation is a bed of red shale with some lighter-colored shale in places, which is a few feet thick. In places the outcrop is wide enough to produce small areas of Meigs soils, but more commonly there is only a narrow strip of mixed soil from this formation and adjacent limestone. At the margin of the Greenbrier formation and the underlying Maccrady, there is some similar interbedded rock. Such areas, occurring in the north-central part of the county, are all small, and in addition to those shown are others too small to map. This mixed soil is productive and, where farmed with adjoining Frankstown soils, supports about the same growth. Bluegrass makes good pasture.

The soil derived from the red earthy limestones together with that from some shaly rock and white limestone of the Moccasin formation were also included in mapping. Belmont silt loam resembles Meigs silt loam or appears to be intermediate between this soil and Hagerstown silt loam. The surface is mainly rather steep, and the outcrop is covered deeply with colluvial material on all but steep slopes. Little of the land is cultivated, but it makes good bluegrass pastures.

A few inextensive areas of Belmont stony silt loam, with projecting limestone outcrops are included in mapped areas of Belmont silt loam.

WESTMORELAND SILT LOAM

Westmoreland silt loam is a compact composite soil made up of closely associated and mixed soils which are derived from noncalcareous shales with interbedded limestones. That part of this soil which has its source in the noncalcareous shales is Dekalb silt loam. The interbedded limestone typically occurs in such thin beds that little unmixed limestone soil occurs, but inclusions of Hagerstown or Frankstown soils and, where some of the rock is calcareous shale, some soil more or less intermediate between the Frankstown and Dekalb soils, are found. The soils are more or less mixed, especially on rather steep slopes, and even where the soil appears to be typical Dekalb material it is somewhat modified; at any rate, in many places it is more productive than typical Dekalb soils. The proportion of calcareous rock present varies considerably throughout the county. The rock is predominantly noncalcareous shale. The soil is derived from the lower part of the Bluefield measures and the upper part of the Greenbrier, where that formation is shaly. In most areas of this soil the proportion of limestone increases rather gradually with depth, and the soil correspondingly grades from Dekalb material, which is little influenced by limestone, to soil resembling Frankstown material. Near the top of the slopes, some soil which was apparently very slightly modified by occasional thin beds of limestone was included in the Dekalb soils. At the base of the slopes, there is commonly a thick layer of rock, mainly calcareous shale or shaly lime-

stone. In its shattered, partly weathered form this shale does not effervesce with acid and the boundary between the Westmoreland and Frankstown soils is not well defined.

This soil is extensive through the entire northwest part of the county. The surface varies from gently rolling to steep. The surface soil, which is shaly in places, is generally rather shallow, passing into shaly material or shale at a depth varying from 20 inches to 3 feet. The lower part of the subsoil may show some grayish mottling where it joins the shale. With little exception, the soil is sufficiently deep to support good growth in ordinary seasons. In the season of the survey (1925), which was dry, even somewhat shaly land, where well cultivated, produced good crops.

The use of this land varies, according to the surface relief. The steeper slopes are mainly in forest of oak and other hardwoods. Even thin limestone beds are frequently marked by occasional black locust and walnut trees. Probably 75 per cent of the land is cleared and under cultivation or in pasture. The stand of pasture grasses, which includes bluegrass, is better than on the Dekalb soils. This soil is well suited to stock raising. Although livestock can not be fattened on these pastures, where the growth varies according to the amount of limestone in the soil, young cattle and sheep do well. With this type of farming, by the use of manure and small quantities of superphosphate, the farm land, even where it approaches or is Dekalb material, may be maintained in a good state of productiveness. On some farms, especially on very hilly land, the soil has been heavily farmed and has washed so much that the texture is largely silty clay loam. Such land is more difficult to farm but produces well when well farmed. The soil has sufficient depth to give good moisture conditions, though in seasons of low rainfall crops do not produce so well as on deeper soils.

WESTMORELAND STONY SILT LOAM

Westmoreland stony silt loam also is a composite soil, made up of soils derived from interbedded noncalcareous shales, with some sandstone and limestone. The soils are of Dekalb material derived from shales, and of Hagerstown and Lowell material from limestone, together with a considerable proportion of mixed soil. The proportion of limestone varies. In the more typical Westmoreland soil the limestones are in beds 1 or 2 feet thick and do not constitute a large proportion of the rock. Some of the beds are thicker, and these give rise to strips of limestone soil. Most of this soil occurs on steep slopes, and the material is very much mixed, especially in the surface soil. The soil is somewhat stony, with occasional narrow ledges of limestone or sandstone and fragments of sandstone. In some places in the hollows a large quantity of Dekalb soil and sandstone from higher formations occurs. Some of the soil derived from shale is shallow and shaly in places, but even on very steep slopes there is generally a good covering of soil. This soil is rather extensive in the northwest part of the county.

Most of this soil is not well adapted to cultivation, more on account of the steepness of the land than its stoniness. Probably 85 per cent

of it is in forest, mainly of oak, with some chestnut, hickory, locust, and other hardwoods. The cleared land is used mainly for pasture, where the native grasses, including bluegrass, make a good growth, though not so heavy as on the limestone soils. Pasture grasses grow best on newly cleared land, but very little of the cleared land is seeded to pasture until it has first been used for cultivated crops.

TILSIT VERY FINE SANDY LOAM

The surface soil of Tilsit very fine sandy loam consists of gray or dark-gray very fine sandy loam 1 or 2 inches thick, underlain by rather pale-yellow very fine sandy loam. At a depth ranging from about 14 to 24 inches this grades into yellow or yellow somewhat mottled with gray heavier very fine sandy loam or very fine sandy clay. At a depth varying from about 24 to 30 inches this gives way to more strongly mottled, somewhat compact very fine sandy loam or very fine sandy clay having a slightly platy structure. This material continues for a few inches and is underlain by yellowish-brown and yellow fine sandy clay which may grade into more reddish-yellow and grayish material of about the same texture. This underlying material is decomposed, somewhat oxidized rock which has undergone practically no textural modification by reassortment. In places the rock is only sufficiently weathered to be softer than the deeper bedrock. The soil is derived from fine-grained sandstone. It is the matured soil developed on smooth areas and corresponds to Dekalb very fine sandy loam. In places the mottled subsoil layer is only slightly developed, and some Dekalb very fine sandy loam is included.

This soil occurs in several areas through the southwest end of the county, and a few small areas are scattered through the Dekalb soils in the northwest part. Moisture conditions in the soil are favorable to crop growth. The compaction of the lower part of the subsoil is ordinarily not pronounced, and on well-farmed land good crops are obtained even in dry seasons. The surface is gently sloping, which affords good surface drainage without erosion. The native forest growth is oak and chestnut, with a few other hardwoods and some pine.

Probably 80 per cent of this soil is under cultivation. Corn and hay are the principal crops, and wheat, oats, buckwheat, and soybeans occupy a smaller acreage. General farming is practiced. A small number of dual-purpose cattle, sheep, and poultry are raised. The pastures are mainly on adjoining slopes of Dekalb soils, but old meadows on this soil are used for a few years as pasture. The land is generally well farmed, crops are rotated, and applications ranging from 100 to 200 pounds of superphosphate to the acre, in addition to manure, are used on grain crops. Yields vary somewhat according to the state of fertility to which the land has been brought but are generally good. Corn ordinarily yields from 30 to 40 bushels to the acre, wheat from 10 to 18 bushels, oats from 20 to 30 bushels, and hay, composed of red clover and timothy or redtop, about 1 ton. Red clover is successfully grown on unlimed land, but as the soil is acid the growth of clovers and grasses is greatly improved by liming. On some farms some red clover has been plowed down and good results were obtained.

TILSIT SILT LOAM

The surface soil of Tilsit silt loam consists of gray or dark grayish-brown silt loam, underlain by pale-yellow or grayish-yellow silt loam. At a depth varying from about 10 to 14 inches this layer gives way to light-yellow silty clay loam; at a depth ranging from about 20 to 30 inches this layer, in turn, is underlain by yellow and gray somewhat compact silty clay loam. This may immediately overlie very shaly material or may pass into decomposed material most of which has been oxidized to a yellowish color and which contains a little more reddish and considerably less gray material than the more compact layer above. However, the typical material at a depth of 3 or more feet is mainly bedded shale fragments, with clay in the interstices. The soil is derived from clayey noncalcareous shales, apparently even where it overlies sandy shale or sandstone. It is the matured soil, developed on smooth surfaces, corresponding to the Dekalb silt loam developed on slopes. In places the mottling and compaction in the lower part of the subsoil are slight and continue for only a few inches, even on smooth areas, and some Dekalb silt loam is included. Where shaly material is reached at the 3-foot depth, the gray mottling in the lower part of the subsoil seems in places to extend into incompletely decomposed material.

Tilsit silt loam occurs in numerous areas through the southwest part of the county, occupying smooth ridges with Dekalb or Meigs soils on the slopes. The surface is undulating or gently rolling, affording good surface drainage. The texture of the lower subsoil layer apparently does not greatly restrict the movement of moisture in the soil, so far as crop production is concerned, for corn makes a good growth on well-cultivated land, even in dry seasons. The forest growth is of oak and chestnut. Nearly all the land is under cultivation.

When dry, the soil in cultivated fields appears considerably lighter or more grayish than Dekalb silt loam, but farmers do not consider it inherently much less productive. The surface relief and good depth of soil render it easy to cultivate and less susceptible to washing than the rolling Dekalb soil, consequently it is easier to build up and maintain in a good state of productiveness. General farming is practiced, and the land, in general, is well farmed. A large acreage is in meadow or temporary pasture, and crops are rotated. Corn and hay are the principal crops, with wheat, oats, buckwheat, and soybeans occupying a smaller acreage. On well-farmed land, corn yields from 30 to 40 bushels to the acre, wheat from 10 to 18 bushels, oats from 20 to 30 bushels, and hay, of red clover, timothy, and redtop, about 1 ton. From 100 to 200 pounds of superphosphate to the acre is applied to grain crops, which are fed on the farm where produced to small numbers of cattle and sheep. The wheat and some corn are sold on some farms where more grain is produced than is necessary for home needs. Clover grows fairly well on unlimed land in a good state of fertility, but the growth of clovers and grasses is much improved by liming such land. Soybeans are well adapted to this acid soil and are increasing in popularity. The yield of soybean hay is much heavier than that of other hay crops, and this is considered a good crop for maintaining the fertility of the land.

DEKALB FINE SANDY LOAM

The surface soil of typical Dekalb fine sandy loam consists of gray fine sandy loam about 1 inch thick, underlain by pale-yellow or yellow fine sandy loam. Below a depth ranging from about 10 to 15 inches this layer grades through fine sandy clay loam into yellow or buff-colored fine sandy clay. Bedrock, or material composed mainly of rock, is commonly reached at a depth of 2 or 3 feet; the depth is practically the same on smooth areas and on slopes. On smooth land or slopes where the surface slopes with the rock formation, as in the large area southeast of Alderson, the bedrock is not so broken or fissured as on steeper slopes, and much of the gently sloping land here is shallow, passing at a depth of about 2 feet into incompletely weathered, very easily broken material, thence into bedrock. On the smoother areas there are patches of Tilsit fine sandy loam or very fine sandy loam, or similar soils. Some sandstone or fine sandy shale occurs in much of this soil. Most of this rock is soft, especially where covered with soil, and it crushes when struck by the plow. In many places, in the lower part of the subsoil, this soft rock or partly decomposed material weathers to a reddish color in spots. Some very small areas of Dekalb very fine sandy loam were included in mapping.

This soil is well drained, though in spring it dries out and warms up more slowly than the heavier soils, and planting does not take place until several days later. The soil also endures drought well; the rock appears to have a large moisture-retaining capacity which may to some extent be transmitted to the soil. The surface varies from gently sloping to rather steep.

This soil occurs in Monroe County mainly along two belts, one, which is derived from the Droop sandstone, in the northwest part of the county, and the other, from the Pocono formation, in the north-central part. The soil is fairly productive, and where the relief is favorable most of it is under cultivation. Some rather steep slopes are used, and by growing corn only on sod can be farmed satisfactorily. Probably two-thirds of this land is in forest of white oak, chestnut oak, black oak, pin oak, chestnut, and other hardwoods. Some white pine is found on land once farmed. Corn, oats, and hay are the principal crops. They are usually grown in a rotation consisting of one crop each of corn and oats and two or more of hay. Following this the land may be used for pasture for a number of years.

From 100 to 150 pounds of superphosphate is commonly applied to the grain crops, and some farmers use a complete fertilizer. Corn yields from 20 to 40 bushels to the acre, oats from 20 to 30 bushels, and hay about 1 ton. A good stand of red clover is easily obtained on that part of the soil which is derived from either of the principal formations. It also grows along the roadside to some extent. Some red and some mammoth clover are grown and they yield well, but timothy and redtop are the principal grasses. A good stand of redtop appears on plowed land without seeding. Orchard grass also thrives. In older meadows and pastures, redtop is the principal grass. Sufficient wheat for home use is grown on some farms, but yields are low. On manured land, good yields of

potatoes of good quality are produced. One farmer reported a yield of 300 bushels to the acre from a small plot. Buckwheat is grown to some extent, yielding from 10 to 20 bushels to the acre.

DEKALB VERY FINE SANDY LOAM

Dekalb very fine sandy loam differs from Dekalb fine sandy loam principally in its finer texture. There are no striking profile differences, even though there is a higher content of silt and very fine sandy loam in the very fine sandy loam soil. This soil is also somewhat more inclined to compact after rains than Dekalb fine sandy loam. Aeration is not quite so thorough as in the fine sandy loam, and for this reason probably this is a little later as a cropping soil. Its best adaptation seems to be for grass and corn. The soil is acid and will need lime for the growth of legumes.

Some areas of Hanceville very fine sandy loam are included in mapped areas of this soil. These areas are light brown, but the principal difference consists in the reddish shade of the subsoil. This red color is the result of better oxidation, which is the result of better drainage caused by the position of the soil.

Areas of this soil are mapped in the extreme southwest part of the county in the general vicinity of Bozoo, in the north part of the county on Carpenter Creek, and in the northwest part on the plateau of Flattop Mountain.

Dekalb very fine sandy loam has about the same agricultural value as Dekalb fine sandy loam. Fertilizers, manure, or soil-improving legumes are needed if good crop yields are to be obtained.

DEKALB STONY LOAM

The surface soil of typical Dekalb stony loam is light-yellow or yellowish-brown loam or silt loam containing sufficient fine sand to cause a noticeable degree of friability. This layer is underlain, at a depth ranging from 6 to 14 inches, by yellow fine sandy clay or silty clay loam. The greater part of the surface is covered with leaf mold from one-fourth to one-half inch thick. Beneath this there may be a little grayish soil overlying the yellow soil, or the surface soil may be darkened with organic matter to a slight depth.

The surface soil varies considerably in texture. Much of the rock and more or less of the sandy material come from a strip of stony sandy soil, or ledge of sandstone near the summit of the slopes. This material is strewn irregularly down the slope, lodging in hollows and on smooth benches. The formation of the lower part of the slope may be largely shale, which would produce the heavier soil characteristic of Dekalb stony loam.

This soil is rather extensive in Potts Creek Valley, and smaller areas occur in the western part of the county. The surface is predominantly rough, and the land is of little value, except as timberland. The forest growth consists of chestnut, chestnut oak, white, red, and other oaks, with some pine in places, and considerable undergrowth of huckleberries and other bushes. Most of the land has been cut over, and the present growth has been more or less injured by fires. Some of the smoother land is under cultivation, but crop yields are not high and the land is difficult to work. The pastures

on this land, in which such grasses as redtop, broom sedge, and other native grasses grow, are of some value, but it is usually difficult to keep them free from brush and briers. A number of abandoned farms were observed.

DEKALB STONY FINE SANDY LOAM

The surface soil of Dekalb stony fine sandy loam consists of light-yellow or yellowish-brown fine sandy loam, underlain at a depth varying from about 1 to 4 inches by pale-yellow or yellow fine sandy loam. At a depth ranging from about 6 to 15 inches, this layer gives way to yellow heavier fine sandy loam or fine sandy clay. The surface of the soil is in most places overlain by leaf mold a quarter of an inch or a half inch thick. The organic-matter content of the surface soil is somewhat variable, and this causes a variation in color. In some places the immediate surface soil, to a depth of an inch or more, is of a grayish shade. The subsoil is friable, and in the lower part, near the bedrock, it is not thoroughly decomposed. In places bedrock is reached at a depth of 2 feet or less, and below a depth of 2½ or 3 feet, thoroughly decomposed material occurs in very few places. Large and small fragments of sandstone are scattered irregularly over the surface and through the soil.

In many areas of this soil, much of or nearly all the rock present comes from a cliff or ledge near the summit of the slope. The rocks are strewn irregularly down the slope and have accumulated most thickly in depressions. The surface is generally rather steep.

In Monroe County, this soil is derived mainly from one formation, the Droop sandstone. Where partly weathered, the rock is rather soft and fine grained. Below the outcrop of this bed the soil extends down the slope for some distance. Generally the deposit of slumped material is so thick that the underlying formations, which are of shale with a little limestone, have little influence on the soil. The soil occurs in a number of comparatively small areas through the western part of the county. Nearly all the land is in forest of red, white, and chestnut oaks, chestnut, and other hardwoods, with some pine in places. It is best adapted to forestry.

A partly podsolized phase of this soil has been included in mapping. In such areas the surface soil is gray fine sand containing some organic matter to a depth of about an inch, where almost white fine sand occurs. At a depth varying from about 3 to 6 inches this layer gives way to a layer of coffee-brown, slightly loamy fine sand, from 1 to 3 inches thick. Below this the soil passes through yellowish-brown into yellow fine sand or light fine sandy clay. Bedrock of yellowish-brown rather soft sandstone is generally reached at a depth ranging from 20 to 30 inches, and rock fragments are numerous in the soil. The development of these surface layers is common farther north in a colder climate but is not so common in the latitude of Monroe County at ordinary elevations, and here the layers are not uniformly developed. Although the soil is podsolized in many places, more often little of the gray layer and none of the brown is found, the soil being similar to Dekalb stony fine sandy loam as it occurs elsewhere in the county. The podsolized soil seems to occur mainly where the surface soil and subsoil are especially light textured.

This included soil occurs on the south slope of Peters Mountain, at elevations of 2,500 or 3,000 feet. Elsewhere in the county, even in rather light-textured material, only a few indistinct indications of podsolization were found. The surface is steep. The forest growth is of oak and chestnut, with some sourwood, maple, and pine, and an undergrowth of huckleberry and mountain laurel. On account of its steepness and stoniness, the land is nonagricultural.

DEKALB SILT LOAM

The surface soil of typical Dekalb silt loam, in forest, ranges from grayish to brownish silt loam to a depth of 2 or 3 inches, below which it is pale-yellow or yellow silt loam. The subsoil is pale-yellow, yellow, or buff silty clay loam or silty clay. Fragments of shale in varying quantities occur throughout the surface soil and subsoil in many small areas. Most of the soil is comparatively shallow, giving way between depths of 2 and 3 or more feet to material composed partly of clay and partly of soft shale. At a slightly greater depth thin layers of bedded, broken shale are present. The shale in the subsoil seems to be somewhat decomposed and is easily crushed when moist. In places some gray partly decomposed shale or clay lies at the surface of the more shaly material. On comparatively smooth areas, there is little or no shale in the soil, but in many places shale is reached at a depth of less than 3 feet. However, moisture conditions are very good. The soil is well drained and is sufficiently deep to carry crops successfully through ordinary periods of drought.

This soil is rather extensive in the southwest part of the county, where it occurs in a large area in association with the Meigs soils. Much of the Dekalb silt loam in Monroe County includes a little Meigs soil, in which the subsoil shows a somewhat reddish cast. The surface varies from gently rolling to steep. Probably two-thirds of the land is in forest, mainly of oak. Most of the smoother areas are kept under cultivation, and the cleared slopes are in semipermanent pastures. Corn and hay are the principal crops, and wheat, oats, and buckwheat are grown on smaller acreages. Corn yields from 20 to 30 bushels to the acre, wheat from 10 to 15 bushels, oats from 15 to 25 bushels, and hay of clover, timothy, and redtop, about 1 ton. Applications ranging from 100 to 200 pounds of superphosphate are commonly used on grain crops. Where the crops are grown in rather short rotations and fertilizer is used, the land may be built up to a somewhat better state of productiveness. Where land has been more heavily farmed, the soil is subject to washing, and yields are low. Old meadows afford good pasture for a number of years, after which the stand of grass becomes thin and weeds and brush make their appearance. Soybeans are a valuable crop for this soil, as they grow and yield heavily on soils deficient in lime. A good yield of good-quality potatoes may be obtained on well-manured and well-fertilized land.

General farming on a small scale is commonly practiced. A few head of dual-purpose cattle are kept, and summer dairying is carried on. The young cattle are sold either as calves or at one or two years of age, as they can not be finished on these pastures although they make fairly good growth on them. A few sheep are

raised on some farms. The farm income is derived from various sources, such as the sale of dairy and poultry products, crossties or other timber, young livestock, a few potatoes or some truck, small quantities of fruit, and other farm products. Some farmers work at outside jobs for a part of the time.

Apples, cherries, plums, peaches, and other orchard fruits do fairly well, but little care is given the trees.

This soil is naturally fairly productive, judging from the timber growth, and it may be kept in a good state of productivity by the use of fertilizers and the maintenance of a good supply of organic matter. Red clover appears to grow fairly well, but the growth of clover, other legumes, and grasses may be greatly improved by the use of lime. There is a marked difference in the appearance of crops on well-farmed land and on worn-out or poorly farmed land.

DEKALB SHALY SILT LOAM

The surface soil of typical Dekalb shaly silt loam consists of grayish or brown silt loam 2 or 3 inches thick, underlain by light-yellow or yellow silt loam. At a depth ranging from about 6 to 10 inches this grades into yellow silty clay loam. The soil differs from Dekalb silt loam in commonly having a greater content of shale and in being more shallow. It varies greatly in these characteristics, not only because of the different beds of the parent rocks but also on account of the relief. Some deep soil is in the ravines, and in the intervening projections areas are rather shallow and shaly. The parent formations are largely dark fissile shale. Beds of more massive shale and soft and hard sandstone are also included. A large part of the rougher areas of this soil is more or less stony. The soil is extensive in the mountains extending through the southeast side of the county. Most of the surface is so steep and rough that the land is unsuited to agriculture. The timber growth consists of white, red, chestnut, and other oaks, chestnut, and some pine.

More or less timber and tanbark have been taken out from time to time, and in recent years large areas have been closely cut over. In the clearings the dead tree tops and low second growth make damage by fire a menace. The original forest growth included much good timber, but the remaining timber is of little value where far from the railway. In the vicinity of Zenith, large areas of rough cut-over land are considered scarcely worth the taxes paid on them.

However, the presence of a large amount of shale in the surface soil does not necessarily indicate that the soil is too shallow for farming, and a large area of smooth land and some rather steeply sloping land are under cultivation. The land is somewhat droughty and yields, except on new land, are not ordinarily large. Much of the smoother land contains little more shale than that mapped as Dekalb silt loam in the western part of the county and is nearly as productive. At the higher elevations, as on the upper slopes of Rich Mountain, the new land is dark, resembling Summers stony loam, and here some very good corn and clover were observed. On older fields the dark color is not noticeable, and many fields which have been farmed for a number of years are worn-out and very shaly.

New land is generally cultivated to corn for a number of years. The darker, richer soil, if farmed conservatively and left in pasture

much of the time, might be kept productive for a long time. However, the cultivation of the slopes can not be permanent. Most of this mountainous land is best adapted to forestry. Much of the land which is suitable for cultivation is so isolated and difficult of access that living conditions are poor.

DEKALB GRAVELLY LOAM

Dekalb gravelly loam closely resembles Dekalb shaly silt loam, but it is lighter in texture. It is derived from the Pocono formation of interbedded sandstone, both solid and cross-bedded and rather soft, and sandy and argillaceous shales. The upper part of the formation, that outcropping next to the Maccrady, is more largely sandstone than the lower part. On steep slopes, the soil is heavier textured than the average texture of the rocks would lead one to expect, and the soil here, although ranging to a fine or very fine sandy loam in places, is mainly loam including considerable silt loam, or, where the soil is shallow, silty clay loam. There are not many large rock fragments, but small blocky or platy fragments of sandstone and sandy shale are generally abundant on the surface and through the soil. Typically there is some deep soil on the sides of the hollows, and the hollows and numerous shallow waterways are very stony. On the sloping ridges between the hollows, most of the soil is shallow.

This soil occurs mainly in a belt occupying the ridge and upper northwest slope of Little Mountain. Another area occupies the northwest side of Eads Ridge.

In some parts of the county this gravelly soil was so stony that it was included with Dekalb stony loam. The formation from which this soil is derived lies adjacent to the Maccrady, which may be traced by the narrow band of Meigs soils formed from it. The surface is, in general, steep and irregular, with numerous deep ravines. On this account the land is unsuited to cultivation and is nearly all in forest of oak and chestnut. It has some prospective value for pasture. Much of the soil is rather dark colored, especially where it occurs at comparatively high elevations, and a few areas, evidently cultivated for only a short time if at all, supported a good growth of grasses, including some bluegrass. A few fields on the ridges are under cultivation. One small peach orchard, sheltered by forest, has produced very well for a number of years.

SUMMERS STONY LOAM

The surface soil of typical Summers stony loam consists of black fluffy loam rich in organic matter. This is underlain at a depth ranging from about 6 to 8 inches by dark-brown or brown loam. At a little greater depth this gives way to yellowish-brown or reddish-brown silt loam. The soil is generally very stony, with ledges and fragments of brown or red fine-grained sandstone. Plowing is difficult, and much of the land approaches the extremely stony material classified as rough stony land.

This soil occurs mainly along ridges, at elevations of more than 3,200 feet. A few small areas of typical appearance occur at lower elevations.

The color of the soil varies from that of the typical soil to that of a dark phase of Meigs soil. The material is darker colored in gaps and on projections, and on the very stony smoother areas it may be only slightly dark. The soil averages considerably darker on very stony land, where the fragments render the subsoil open.

Drainage over this soil is good. Nearly all the land is in forest of oak and chestnut, but here and there less stony areas are cleared. Corn grows well, although the season is somewhat shorter and cooler at this elevation. Dent corn is preferred to flint corn. Clover and timothy give heavy yields when cut for hay, but the fields are used mainly as pastures. Bluegrass thrives, making a sod with little or no mixture of other grasses. Most of the land is so stony that it would be difficult to keep the brush cleared from the pastures, and the land is probably best adapted to forest.

MEIGS SILT LOAM

Meigs silt loam consists of undifferentiated alternating strips of Dekalb silt loam, Upshur silt loam, and soil of an intermediate type, occurring so intermingled that separation is not practical. The parent rocks of the two soils are interbedded, or, in other places as on mountain sides, the materials have worked down the slopes and become mixed.

The surface soil of Meigs silt loam consists of dark chocolate-brown or Indian-red silt loam which becomes somewhat lighter in color below a depth of about an inch. At a depth ranging from about 6 to 10 inches this layer gives way to Indian-red silty clay loam or silty clay, friable or somewhat stiff and generally containing some soft shale. At variable depths, commonly between 18 and 30 inches, this layer is underlain by disintegrated clayey but slightly weathered material mixed with shale. This grades, generally within a few inches, into material which is mainly shale, with clay filling the interstices. This broken shale commonly continues at least 2 or 3 feet before solid bedrock is reached.

Some shale occurs at or near the surface, even on very smooth areas. The color of the soil is practically the same as that of the bedrock and is only changed at the surface by the addition of organic matter. The undisturbed parent rock is somewhat limy. Where exposed in deeper road cuts, some of the rock effervesces with acid. The lime is largely removed in the earlier stages of weathering, so that none of the fragmentary rock effervesces.

The surface soil of the Dekalb soil occurring in close association with the Upshur soil is generally typical in color, but the color of the subsoil ranges to reddish yellow, which is more apparent when the soil is moist. On slopes, the soils are more or less mixed by surface wash.

The Upshur soil is somewhat stronger than the Dekalb soil. On well-farmed areas of the typical Upshur soil on which applications ranging from 100 to 200 pounds of commercial fertilizer have been made, corn ordinarily yields from 25 to 40 bushels to the acre, oats from 20 to 30 bushels, wheat from 10 to 15 bushels, and hay about 1 ton. Bluegrass grows to some extent, especially in pastures used more or less as feed lots, about buildings, and on new land, especially

at the higher elevations. Ordinarily the pasture growth is composed of such grasses as timothy, redtop, and orchard grass from seeded meadows. On old worn-out fields the sod does not hold well, when weeds, briers, and other bushes encroach.

Meigs silt loam occurs extensively throughout the northwest side of the county. It is derived mainly from the Mauch Chunk formation and consists mainly of Dekalb silt loam, with comparatively narrow streaks of Upshur silt loam. The surface is predominantly strongly rolling or steep, with areas of smoother land on the tops of the ridges. The relief is of much greater importance than the predominance of either soil in determining the use of the land. The areas of smoother land are generally in cultivation, but most of the more moderate slopes are kept in grass as much of the time as possible. Large areas of the steeper land are in forest consisting of various oaks, such as chestnut, white, and red oak; chestnut; and other hardwoods, with some pine in places. Many slopes once farmed and abandoned support a growth of scrubby pine. Probably 75 per cent of the land is in forest.

The steeper slopes are somewhat stony with loose rocks, and here and there narrow ledges of sandstone lie near the surface or outcrop in places. The rock formations are predominantly shale. The soil even on very steep slopes is practically free of stone and its thickness averages nearly the same as on more moderate slopes.

The soil on slopes is subject to erosion under cultivation. Where slopes have been cleared the land has generally been used for cultivated crops continuously, and much of this land is worn-out, that is, there are patches where the surface soil has washed away, leaving the soil shallow and somewhat shaly. Most of these worn slopes are now kept in grass as much of the time as possible.

General farming, generally on a rather small scale, is carried on. Small numbers of cattle and sheep are raised. Only sufficient feed for use on the farm is produced, and the principal sources of income are livestock, poultry, and dairy products. Cattle can not be finished on these pastures and can not be economically finished on grain but are generally sold when 1 or 2 years old. Sufficient wheat for home use is generally produced, and soybeans are becoming a common crop. Clover is grown to some extent, but the soybeans are a more productive legume on this somewhat acid soil. From 100 to 200 pounds of superphosphate are commonly used on grain crops. Fair yields of grain and hay are thus obtained, and the sod in old meadows affords good pasture for several years.

Meigs silt loam, derived from the Maccrady formation, occurs in a narrow strip on the southeast side of the main limestone area, which is from the Greenbrier formation, and in a few areas within the limestone region. It contains more Upshur soil than Dekalb, so that on steep slopes much of it seems rather predominantly Upshur, but on smoother land a considerable proportion of Dekalb or intermediate soil appears. This Meigs soil is farmed in comparatively short rotations where the surface is smooth, but the slopes are kept in grass as much of the time as possible. This is naturally somewhat better grassland than the average Meigs soil, but under cultivation the slopes are subject to erosion particularly on one bed which

generally weathers to a shallow soil containing finely divided shale at a slight depth. Much of the area near Rehoboth Church has been carelessly farmed at some time and is badly eroded.

Toward the southwest, the formation outcrops on steep slopes and Dekalb soils occupy the crests of ridges. Here, the soil is irregularly modified by material worked down from the Dekalb soils. In places it is altogether obscured, and most of the soil in the hollows is gravelly or somewhat stony loam of Dekalb material. The soil in many of these hollows is somewhat dark, and this colluvial, unstratified soil makes good grassland.

MEIGS GRAVELLY SILT LOAM, COLLUVIAL PHASE

The surface soil of Meigs gravelly silt loam, colluvial phase, is light-brown or somewhat reddish-brown silt loam or silty clay loam. It grades, at a depth varying froim about 8 to 12 inches, into reddish friable heavier loam or fine sandy clay. The soil is outwash material at the mouths of ravines leading down from Peters Mountain, where they open out on the purer limestone formation. Many of the streams disappear here or farther back in sinks. The material is derived mainly from red shales, red sandstones, and white sandstones. Some of the larger areas have a rolling surface, and the soil is rather intermediate between Meigs gravelly silt loam and the colluvial phase of Meigs stony loam. The gravel of red and white sandstone is subangular and is thickly distributed through surface soil and subsoil. The deposits overlie limestone, and in some places on rolling areas residual soil or soil with residual subsoil occurs, but generally the deposits are several feet thick. The forest growth is of oak and chestnut, with some black locust, walnut, and other hardwoods in places.

Nearly all the land has been cleared of timber and of the larger stones and is under cultivation. Corn, wheat, oats, and hay are the principal crops. The land is well farmed, and small applications of superphosphate are used on the grain crops. Corn ordinarily yields from 30 to 50 bushels to the acre, wheat from 10 to 18 bushels, and clover and timothy hay about 1 ton. The stonier land is used for pasture. Apple trees thrive and produce fairly well. Some farmers grow a little fruit for market.

MEIGS STONY SILT LOAM

Meigs stony silt loam is also a composite soil made up of intermingled Upshur and Dekalb stony silt loams. In Monroe County, the soil is derived mainly from the Medina and Clinton formations. The red Medina and Clinton formations are mainly red rock, and most of the soils on very steep slopes derived from interbedded variegated shales appear red. The intervening white Medina formation is comparatively narrow. The soil is mainly Upshur material, but the proportion of Dekalb or intermediate soil is sufficient to class the soil as Meigs rather than Upshur. Much of the rock strewn over the soil is white sandstone from the white Medina formation, which generally outcrops on or near the summit of the ridges. Considerable quartizite is present in the Clinton formation and fragments of red sandstone are also common.

Meigs stony silt loam occurs principally in the mountains in the eastern part of the county. Some less extensive areas in the western part are derived from the Mauch Chunk formation.

In the eastern part of the county this soil occurs mainly at high altitudes, in association with Summers stony loam, and generally has a darker surface soil than is common at lower elevations. The typical surface soil is dark-brown silt loam from 1 to 2½ inches thick, passing into chocolate reddish-brown silt loam. This in turn passes into chocolate reddish-brown silt loam or silty clay loam.

In places the texture of this soil and of the included Dekalb soil ranges to a loam. More or less stone, mainly fragmentary, occurs on the slopes, and the ravines are very stony with large sandstone blocks broken from the white Medina formation, which forms a strip of very stony land or cliff near the summit of most of the ridges.

The surface is very steeply sloping, and practically all the land is wooded with chestnut and chestnut oak, with a little hickory, maple, black walnut, and other trees. On a small farm on smoother land on the summit of Peters Mountain, the soil, which has evidently been farmed for some time, shows little darkening of the surface soil, except in patches. The land is very stony and evidently has been poorly farmed. A few fields, on steep but less stony land, have been cleared. The soil is productive, but as the areas are rather inaccessible and difficult to farm, most of the fields are now used for pasture. The native grasses, including bluegrass, grow well, especially on newly cleared land. Heretofore, clearing land for immediate use as pasture has not been practiced, but one farmer was planning such utilization for land from which the large timber had been cut.

MEIGS STONY LOAM, COLLUVIAL PHASE

The soil classified as Meigs stony loam, colluvial phase, is derived from mixed materials, partly from red shales and sandstones such as give rise to the Upshur soils and partly from light-colored sandstone. Most of the material is probably derived from the Medina rocks and occurs on the upper slopes of Peters Mountain. A deep blanket of this material, fallen and washed down from the north side of the mountain, overlies the calcareous Ordovician formations. The same conditions occur less extensively on the south side of Gap Mountain in the general vicinity of Gapmills.

The typical surface soil is grayish-brown loam, though it ranges to friable silt loam and heavy very fine sandy loam. This layer is underlain, at a depth ranging from about 1 to 3 inches, by yellowish-brown soil of the same texture, This layer gradually assumes a light-reddish or pinkish shade until at a depth ranging from about 18 to 30 inches the color is pinkish or light chocolate reddish. The texture remains about the same as or slightly heavier than that of the surface soil. Large and small fragments of both light-colored and red sandstone are scattered over the surface and through the soil.

On moderately rolling areas the soil to some depth appears much like Dekalb soil. The depth to distinctly reddish material varies somewhat with the relief, the reddish or reddish-brown shade being stronger and appearing at a slight depth on the slopes. The lower

slopes of the mountain are benched to some extent, with deep ravines extending down to the edge of the limestone. Many of the streams flowing down these ravines apparently terminate here, the water flowing into sinks. Even on the steep slopes of the ravines there is a large quantity of talus material and the soil to a considerable depth is apparently of the same origin, though patches of residual soil or soil in which the subsoil is residual are included. On broad areas of moderately rolling land, the soil is mainly light loam or ranges from very fine sandy loam to fine sandy loam. Apparently the proportion of the different kinds of rocks varies somewhat, and the texture of the soil varies accordingly. It is generally somewhat lighter in texture toward the southwest end of the county.

Many bowlders and a few rocks several feet in diameter, of the white sandstone formation, are strewn over the moderately rolling land, which is stonier than the steeper slopes. The red rocks are less numerous, and most of them are smaller.

Probably 85 per cent of this land is in forest, mainly of chestnut, chestnut oak and other oaks, and some maple, hickory, black locust, and other hardwoods. A number of small farms consist almost entirely of this stony land. The land produces well, but it seems almost impossible to get it reasonably clear of stones. Some fields have been fairly well cleared of the larger stones, but most of them are still so stony that farming is very difficult. Corn and hay are the principal crops. Corn yields from 25 to 50 bushels to the acre, and clover and timothy hay about 1 ton. Clover grows well on this acid soil. Some bluegrass grows and together with other native grasses makes good pasture on land which has not been much worn. Apple trees thrive and produce fairly well. Some very stony farms on this soil have been abandoned.

HUNTINGTON FINE SANDY LOAM

The surface soil of typical Huntington fine sandy loam consists of brown or yellowish-brown fine sandy loam, underlain at a depth ranging from about 10 to 16 inches by yellowish-brown or yellow heavier fine sandy loam or fine sandy clay. Some areas of Huntington gravelly fine sandy loam and Huntington gravelly loam have been included with this soil in mapping. These included soils are similar to typical Huntington fine sandy loam, but as their names imply they have a larger content of gravel.

This soil is inextensive in Monroe County but occupies most of the bottoms of Greenbrier River. These bottoms are high, and most of the soil is above ordinary overflow. The land is well drained and productive. It is well suited to the production of garden and truck crops and is used to some extent for this purpose near Alderson. Corn and hay are the principal crops. Small quantities of commercial fertilizers are commonly applied to the grain crops. Corn yields from 40 to 75 bushels to the acre, and clover and timothy hay a ton or more.

HUNTINGTON SILT LOAM

The surface soil of typical Huntington silt loam is rich-brown mellow silt loam, which at a depth ranging from about 12 to 16 inches is underlain by brownish-yellow silty clay loam. Some mottles of

dark bluish gray may be present in the lower part of the subsoil. The soil is alluvium, and part of it has been washed from the limestone uplands. It is not very extensive in Monroe County. The principal areas are in the bottoms of Indian Creek.

This soil is well drained and productive. It is subject to occasional overflow, but overflows very rarely occur at such times as to do much damage to crops. Most of the land is under cultivation or in pasture. Corn, wheat, and hay are the principal crops. Corn, which may be grown for several years in succession, yields from 50 to 80 or more bushels to the acre. Wheat yields from 10 to 20 bushels, and clover and timothy hay as much as 2 tons. Bluegrass grows well, and on many farms the narrow bottoms are included in pasture land on account of the water supply and also because the grasses grow better in dry weather than on uplands.

ELK SILT LOAM

The surface soil of typical Elk silt loam consists of yellowish-brown silt loam, passing at a depth ranging from about 4 to 6 inches into yellow or pale-yellow silt loam. This grades, at a depth of about 15 or 18 inches, into yellow silty clay which may be clear in color or may show some gray and rust-colored specks in the lower part of the subsoil. The lower subsoil layer may be moderately dense but is not noticeably so dense as that in the corresponding more thoroughly matured Monongahela silt loam. In places the somewhat reddish color of the subsoil is caused by inclusions of Cumberland silt loam.

A few areas of gravelly silt loam, such as the one at Nickells Mill on Second Creek, were included with Elk silt loam in mapping. The gravel is small and embedded in the soil, so that the land is not droughty. Some of this soil consists of colluvial or outwash material transported from Frederick gravelly silt loam. An area of somewhat gravelly fine sandy loam or loam, at Peterstown, was also included. Here the soil is well drained and productive and is well suited to garden and fruit crops.

Elk silt loam consists of alluvium and occupies terrace positions. The material is derived, at least in part, from limestone soils. The soil is not extensive in Monroe County, the small areas occurring at intervals along the larger streams. The surface is undulating or gently sloping. The soil is well drained and productive and is nearly all under cultivation. Corn, wheat, and hay are the principal crops. On well-farmed land, corn yields from 40 to 60 bushels to the acre, wheat from 10 to 20 bushels, and red clover and timothy hay a ton or more. Small applications of commercial fertilizers are used on the grain crops.

POPE LOAM

The surface soil of Pope loam is brown mellow loam from about 10 to 15 inches thick. It is underlain by yellowish-brown or reddish-brown heavier loam or silty clay loam. There may be some gray mottling in the lower subsoil layer in places. The soil is alluvium brought down from Dekalb and Meigs uplands to the first bottoms of streams. Alluvium including sufficient wash from the Meigs soils

to give a pronounced reddish color is really Moshannon soil, but, on account of its slight extent, has been included with Pope loam in mapping.

A few included areas of very stony material washed down mainly from Dekalb and Meigs uplands are mapped with this soil. The soil material is predominantly brownish or yellowish-brown loam or silt loam, and most of the rocks are light-colored sandstones, ranging in size from pebbles to large bowlders. This included soil occurs along swift-flowing mountain streams in various parts of the county, at two levels, one of which is above overflow. Nearly all this land is too stony for cultivation, and it has been left in forest of oak and other hardwoods. A few small areas are cultivated, and some are used for pasture.

Pope loam occurs mainly in the bottoms of Potts Creek, in the eastern part of the county. Nearly all the land is cleared, but as it is subject to overflow, a large part is in pasture. There is not much bluegrass, but redtop, timothy, and other grasses thrive and afford good grazing even in dry seasons. Some of the land is under cultivation, principally to corn and hay. Corn yields from 30 to 50 or more bushels to the acre and clover and timothy hay from 1 to 1½ tons.

POPE GRAVELLY LOAM

The surface soil of typical Pope gravelly loam consists of brown silt loam from about 8 to 12 inches thick. This is underlain by friable yellowish-brown or yellow silty clay loam. Varying quantities of large and small gravel from shale and sandstone are distributed through the surface soil and subsoil. Part of the soil is so gravelly that it is droughty and not well suited to cultivation, and in part of it the gravel is so embedded in the soil as not to affect it injuriously. The soil consists mainly of wash from Dekalb soils, and in places includes some wash from Meigs soils. The soil, for the most part, is alluvium, but it includes numerous small patches of outwash from ravines, built up above the first bottoms.

Pope gravelly loam is not extensive in this county but occupies the narrow bottoms of some small mountain streams in the northeast part. The forest growth is of oak, hickory, and other hardwoods. Probably half of the land is cleared and under cultivation or in pasture. Good yields of corn and hay are obtained from some very gravelly soil, and on some farms yields varying from 30 to 50 bushels of corn and from 1 to 1½ tons of hay are obtained.

A few small areas of Pope silt loam and of Moshannon silt loam are included in mapped areas of this soil. The Moshannon soil differs from the Pope in containing a large proportion of wash from Meigs soils which gives a pronounced reddish cast to the soil.

LINDSIDE SILT LOAM

Lindside silt loam consists typically of a brown or yellowish-brown silt loam surface soil, grading at a variable depth into a mottled yellow and gray subsoil. The lower part of the subsoil may be somewhat heavy, tough clay, at a depth of 3 or more feet. This soil resembles Huntington silt loam. In typical areas the surface soil, to a depth ranging from 10 to 20 inches, appears like the Huntington

soil, but the lower part of the subsoil is more gray. Much of the land mapped as Lindside silt loam lying along the streams and at the mouths of hollows is typical Huntington soil, whereas that in low spots is a light-colored phase of the Lindside soil.

Lindside silt loam is inextensive in Monroe County. The soil is alluvium derived, in part at least, from limestone upland soil. It occupies the rather narrow bottoms of many of the small streams in the western part of the county. These stream bottoms may be flat, or they may slope gently toward the stream, so that in many places only a narrow strip is inundated and some of the soil is practically above all overflow. The mottles in the subsoil are not caused by prolonged overflow but by poor underdrainage. Some alluvial or partly colluvial soil along short submerged streams or in sinks was included with this soil in mapping.

Crawfish burrows are very common, and they frequently damage corn considerably. Clover and timothy thrives and produces well on undrained land. Such land is used mainly for meadows and pasture. Tile-drained land produces good grain crops.

Corn yields from 50 to 75 bushels to the acre, and wheat and oats produce well, though wheat is subject to damage by rust. Small applications of commercial fertilizers are commonly used on grain crops. The use of burnt lime is considered profitable, not only on account of its favorable effect on the soil, but because it causes the disappearance of crawfish for several years.

Lindside silt loam, light-colored phase.—Lindside silt loam, light-colored phase, typically consists of a mottled brown or rust-brown and gray silt loam surface soil, underlain by mottled gray and yellow silt loam or silty clay loam. The lower part of the subsoil is somewhat compact in most places and is heavy plastic clay in a few places. In lower, wetter situations, the gray color is more predominant than in higher places. In places the surface soil may be brown, especially near the streams where it has apparently been recently deposited.

This phase of soil occurs in poorly drained bottoms. It is inextensive in Monroe County, the only area of any size being in a broad part of the bottom of Second Creek east of Union. Here the surface is flat, and the stream does not have much fall. This land was once drained by open ditches, and good crops of hay were obtained year after year. The ditches have been allowed to fill, and the land is grown up in wild grasses. It is now used for pasture.

HOLSTON SILT LOAM

The surface soil of Holston silt loam is light-brown or grayish-brown silt loam, passing at a depth ranging from about 10 to 14 inches into light-yellow silt loam or silty clay loam. The lower part of the subsoil is somewhat compact silty clay loam, mottled with yellow and gray. The soil material is alluvium brought down from Dekalb and Meigs uplands. It occurs on terraces. The surface is undulating or gently sloping and surface drainage is good, except along a few shallow drainage ways where the surface soil and subsoil are gray or mottled with gray. The compaction of the lower subsoil layer is not marked and apparently is not sufficient to greatly retard underdrainage.

There have been included with this soil in mapping some small areas of Holston fine sandy loam where the surface soil is yellowish-brown or yellow fine sandy loam, underlain at a depth ranging from about 8 to 10 inches by yellow fine sandy clay or silty clay loam. The somewhat compact, mottled gray and yellow silty clay loam subsoil layer begins at a depth ranging from about 18 to 30 inches.

Holston silt loam is inextensive in Monroe County, the only fair-sized areas occurring on Potts Creek in the eastern part of the county. The terraces are at several levels or slope gradually. They lie from 50 to 200 feet above the first bottoms. A few rounded gravel or cobblestones indicate the source of the soil material. This soil differs but slightly from the corresponding residual soil, Tilsit silt loam.

Nearly all this land is cleared and under cultivation. Corn, oats, and hay are the principal crops. Where the land is well farmed and superphosphate is used on grain, good crop yields are obtained.

MONONGAHELA SILT LOAM

The surface soil of typical Monongahela silt loam consists of yellowish-brown or pale-yellowish silt loam, passing at a depth varying from about 8 to 12 inches into yellow or light-yellow silty clay loam. At a depth ranging from about 20 to 30 inches this layer is underlain by somewhat compact, mottled yellow and gray silty clay loam. This soil is similar to Elk silt loam in origin and position but differs from it in being rather more mature, as is evidenced by the somewhat lighter color of the surface soil and the presence of mottles in the lower part of the subsoil.

Monongahela silt loam is typically and uniformly developed on a few rather high terraces. In some lower positions, its characteristics are not pronounced, and in some places it is affected by seepage or by a compact substratum. It is inextensive in Monroe County, occurring only in small areas along the larger streams. The surface is undulating or gently sloping, giving good surface drainage, and the underdrainage is adequate in most areas, if the compaction of the lower part of the subsoil is not pronounced. Even on rather light-colored well-farmed land crop yields seem nearly as good as on Elk silt loam. On Second Creek a few areas of loam texture were included in mapping. The larger area at Patton is rather gravelly with sandstone fragments and is apparently not so productive as areas in which the soil is less thoroughly matured.

ATKINS SILT LOAM

The surface soil of typical Atkins silt loam consists of grayish-brown or gray silt loam, showing some rust-brown mottles. The subsoil is mottled gray or bluish-gray and yellow silty clay loam, which is fairly friable to some depth but which becomes rather compact in the lower subsoil layer. In places tough grayish clay, mottled with rust brown or yellow, occurs at a depth of about 3 feet. This description applies to the soil which has developed under very poor drainage conditions. Much of this soil in Monroe County is not so poorly drained but ranges from the typical soil through

intermediate soil, which is unmottled to some depth, to Pope material having only a few mottles in the lower part of the subsoil.

Commonly the soil near the stream and at the mouths of hollows, where considerable outwash has accumulated above the general level, is unmottled to some depth. In places the bottoms slope somewhat toward the stream, and the poor drainage is apparently caused by seepage. The soil is doubtless more variable now than when the uplands were forested, as the amount of wash from cultivated slopes is much greater. Such land, however, is patchy with typical Atkins soil, or has only a slight thickness of unmottled brown surface soil. Atkins silt loam occupies the narrow bottoms of many of the small streams through the western part of the county, where the wash is from Dekalb and Meigs uplands, with little or no modification by material from limestone soils. The typical soil does not differ greatly from Pope material, as the soil is similarly acid and deoxidized, and the original differences of the materials have greatly lessened.

The typical soil is used mainly for pasture or, where very poorly drained, is wooded or grown up in wild grasses and sedges. Most of the land, however, consists of the somewhat better-drained soil and is cultivated to corn at intervals but is left in meadow and pasture for much of the time. Timothy, redtop, and clover thrive and make good meadows and pasture.

ROUGH STONY LAND

The land mapped as rough stony land is extremely rough and stony, is of no agricultural value, and generally has little value as timberland. No large areas of this material occur in Monroe County. In the northwest part, some cliffs occurring in places at the margins of the plateaus and ranging from 20 to 50 or more feet in height, were included with this land, and on Second Creek and Greenbrier River, some precipitous slopes, with numerous ledges of outcropping rock, were included. In the southeast part, some small areas of the colluvial phases of the Meigs soils, which are almost covered with large rocks, were also included. Many small areas of rough stony land are included in the stony soils in the mountains.

SUMMARY

Monroe County lies at the southeast border of West Virginia. The land area is 473 square miles. The county lies in the Appalachian region, and the land is principally mountainous or very hilly but is diversified by many large and small areas of smooth or moderately rolling land which occur as high valleys in the southeast part and as plateaus, lying at various elevations, in the western part. The immediate valleys of the larger streams are narrow, with steep slopes. In 1920 the population of the county was 13,141. The towns are small, and much of the county is rather distant from railway facilities, but the main roads are good. The climate is temperate. The mean annual rainfall is 38.45 inches.

Agriculture is the only important industry. Livestock farming, mainly the production of beef cattle with small numbers of sheep, is the principal type of farming. Additional income is derived from

the sale of dairy and poultry products, lumber, and other commodities. The crops grown are mainly those required for winter feeding.

About 80 per cent of the land in the county is in farms. Of this, one-third is in crop land or plowable pasture, one-third in pasture, and one-third in forest. Corn, wheat, and hay are the principal crops. Other crops of less importance are oats, soybeans, buckwheat, and potatoes. Much of the pasture is good bluegrass land. Mixed timothy and clover is the principal hay crop. Small amounts of commercial fertilizers are commonly used on the grain crops, and lime is used on many farms. Most of the farms are not large, and 88 per cent of them are farmed by the owners. Little labor is hired.

The characteristics of the soils of the county are the product of climate, age, and the character of the parent material. The climate at different elevations varies sufficiently to affect the accumulation of organic matter. At the higher elevations the accumulation is greater. There is some development of podsolized soil, in which the organic matter has a characteristic coffee color. Throughout the county the soils are somewhat acid as a result of the leaching common in a humid climate.

On smooth surfaces, the soil has assumed a stratified arrangement and generally has a somewhat lighter-colored surface soil and more compact subsoil than corresponding slope-land soils. The lower, compact subsoil layer is somewhat mottled with gray.

Thick beds of rocks are exposed in the county. The rocks range from noncalcareous shales and sandstones to somewhat calcareous red shales and limestones of various types.

The soils of the county are grouped in series on the basis of similarity of characteristics. Nineteen soil series are represented, and two composite soils and one miscellaneous classification (rough stony land), are also mapped.

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[PUBLIC RESOLUTION—No. 9]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]

Areas surveyed in West Virginia, shown by shading

U. S. GOVERNMENT PRINTING OFFICE: 1930

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U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
HENRY G. KNIGHT, CHIEF
A. G. McCALL, CHIEF, SOIL INVESTIGATIONS
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP

MONROE COUNTY
WEST VIRGINIA

WEST VIRGINIA GEOLOGICAL SURVEY
DAVID B. REGER, ASSISTANT GEOLOGIST IN CHARGE

LEGEND

Atkins silt loam (A)	Dekalb silt loam (Dl)	Holston silt loam (Hs)	Pope gravelly loam (Pg)
Belmont silt loam (Bs)	Elk silt loam (Es)	Lindside silt loam (Ln)	Pope loam (Pl)
Clarksville gravelly silt loam (Cg)	Frankstown silt loam (Fs)	Ln — Light colored phase	Shelbyville silt loam (Sh)
Dekalb stony fine sandy loam (Dm)	Frankstown, Hagerstown, and Lowell stony silt loams (*Undifferentiated*) (Fh)	Lowell stony silt loam (Ls)	Summers stony loam (Ss)
Dekalb stony loam (Dk)	Frederick gravelly silt loam (Fg)	Meigs stony silt loam (Ms)	Tilsit very fine sandy loam (Tv)
Dekalb gravelly loam (Dg)	Hagerstown silt loam (Hs)	Meigs stony loam, Colluvial phase (Mc)	Tilsit silt loam (Tl)
Dekalb shaly silt loam (Dh)	Hagerstown and Lowell stony silt loams (*Undifferentiated*) (HL)	Meigs gravelly silt loam, Colluvial phase (Mg)	Westmoreland stony silt loam (Ws)
Dekalb fine sandy loam (Df)	Huntington fine sandy loam (Hf)	Meigs silt loam (Ml)	Westmoreland silt loam (Wl)
Dekalb very fine sandy loam (Dv)	Huntington silt loam (Hf)	Monongahela silt loam (Mn)	Rough stony land (R)

Hugh H. Bennett, Inspector, District 4.
Soils surveyed by J. A. Kerr.

BASE MAP FROM
U. S. GEOLOGICAL SURVEY SHEETS

Scale of 1:250000
1 0 1 2 3 4 Miles
1 0 1 2 3 4 5 Kilometers

Contour interval 50 feet.
Datum is mean sea level.

LITHO EASTERN OFFSET INC. BALTO.

Field Operations
Bureau of Soils
1925

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

- City or Village, Roads, Buildings, Wharves, Jetties Breakwater, Levee, Lighthouse, Fort.
- Secondary roads and Trails
- Railroads Steam and Electric
- Bridges, Ferry
- R.R.crossings, Tunnel
- Ford, Dam
- School or Church Cemeteries
- Mine or Quarry Mine dumps Made land
- Bluff Escarpment, Rock outcrop and Triangulation station
- Stony and Gravelly areas
- Soil boundaries
- State / County Boundary lines
- Land Grant / City or Village Boundary lines
- Civil Township / Reservation Boundary lines
- U.S.township and section lines

RELIEF
(Printed in brown or black)

- Contours Depression contours
- Prominent Hills Mountain Peaks
- Sand, Wash, and Sand dunes
- Shore and Low-water line, Sandbar

DRAINAGE
(Printed in blue)

- Streams
- Lakes, Ponds, Intermittent lakes
- Intermittent streams
- Springs, Canals and Ditches, Flumes
- Swamp Salt marshes
- Submerged marsh Tidal flats

The above signs are in current use on these maps. Variations from this usage appear in some maps of earlier dates.